TARGETING COLLABORATIVE REFERENCING IN APHASIA: EVIDENCE FROM A MIXED METHODS TREATMENT STUDY

BY

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DISSERTATION

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ABSTRACT

The current study integrates the distributed communication theory (Hengst, 2015) with the social philosophies of interventions for aphasia with the aim of investigating the communicative changes in four individuals with chronic aphasia and their clinician-partners during the study sessions (both during the treatment, and during probe conditions), as well as outside of the study sessions. Adopting an overarching interpretive case study design and an embedded multiple-probe single-case experimental design, this mixed methods study combines qualitative ethnographic methodologies (e.g., observations, interviews, patient-reports), discourse analysis procedures (e.g., collaborative referencing), and quantitative experimental methodologies (e.g., multiple-probes) to understand the different dimensions of the process and effects of treatment.

Data collection included 108 videotaped study sessions with 27 sessions completed by each of the four participant pairs that consisted of the following: (a) 2 pre-treatment sessions (b) 5 baseline sessions (c) 15 barrier treatment protocol (BTP; Hengst, Duff & Dettmer, 2010) sessions with 5 weekly treatment probes, and (d) 5 maintenance sessions. The baseline, treatment probe and maintenance sessions consisted of 2 dependent variables, a collaborative confrontation naming (CCN) probe of 12 personally relevant probe-cards per session, followed by a 10-minute conversation probe using the mediated discourse elicitation protocol (Hengst & Duff, 2007). Each BTP treatment session (i.e., independent variable) consisted of 6 trials of the collaborative referencing task, during which the client and clinician alternatively took turns to identify and match personally relevant treatment-cards to their numbered boards with a partial-barrier separating them. Two patient-reported outcome measures— communication confidence profile (Babbitt & Cherney, 2010), and conversation profile (Whitworth, Perkins & Lesser, 1997) were also administered during baseline, treatment probe and maintenance sessions. All the treatment sessions and conversation probes were transcribed and coded for discourse analysis. The CCN probes were scored by two independent raters using the adapted PICA scale (Porch Index of Communicative Ability; Porch, 1971); the conversation probes were analyzed for the changes in non-content conversational synchrony (Gupta, 2012) and content-conversational synchrony (e.g., Hengst et al., 2016).

Results from the analysis for collaborative referencing revealed that all four participant-pairs successfully completed the 15 barrier treatment protocol sessions, and the findings were

consistent with the collaborative referencing model (Clark & Wilkes-Gibbs, 1986) in that, there was a high mean accuracy of card placement of 99.95%, with reduced collaborative effort across trials per card placement, and also with simplification of the initiating referencing expressions across trials and sessions. Extending beyond the model, we found a high number of repetitions of card labels with increased consistency in using agreed-upon labels across participant pairs supporting the findings from Hengst et al., (2010), which suggest that repeated engagement in collaborative referencing serves as the grounds for learning. Results from the analysis of the CCN probe revealed a positive treatment effect on naming with a Tau-U treatment effect size of 0.92 at $p<0.0001$, indicating a functional relation between the treatment and naming. Analysis of non-content and content conversational synchrony revealed variable results across participant-pairs and across sessions, indicating no functional relation between the treatment and conversational synchrony. Results from the two patient-reported outcome measures showed that there were reports of increased communication confidence and increased conversational participation in diverse activities and situations, indicating a positive impact of the treatment outside of the study sessions, in the everyday lives of the four participants.

Consistent with the previous literature on barrier treatment protocol, this study found successful collaborative referencing and verbal learning of references within treatment sessions in all four participant pairs. More strikingly, the results indicated that the treatment effects were generalized to a clinical naming task, and also that the patient reports indicated a significant impact of the treatment on the communicative lives of individuals with aphasia. This research highlights the use of communicative engagement as a therapy tool for aphasia, with clinical implications regarding both assessment and management of neurogenic communication disorders. They also point to the potential benefits of using patient-reported outcome measures and discourse analysis measures to design and study novel treatment approaches to better meet the real-life communication goals.

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Chapter 1

Aphasia and Language Learning

"*We must broaden our therapeutic contexts to include the dynamics of family and community and to rejuvenate disrupted life processes that seemingly stand in the way. As such, aphasia treatment should not be a process of a person, but of people. It should not be a process of just language and communication repair, but of facilitating purpose and meaning in life and strengthening ties with others in those natural life contexts that matter the most"*

-Lyon (1999, 689)

As a graduate student clinician in Mysore, India, I was involved in providing communication assessment and therapy services to over 150-200 clients with aphasia and other neurogenic communication disorders across various settings, which grew to be one of my core areas of research interests. As a student clinician, the assessment and treatment methods I learned to administer for clients with aphasia were based on traditional approaches, which focused primarily on the individual's impaired speech and language skills with little attention to the social context or everyday communication needs. Although generalization of skills was worked on after the acquisition of skills, generalization to different contexts often seemed to be limited. Despite this, my clients often showed positive results on evaluation of treatment progress using clinical tests. I routinely found my clients improving on naming, repetition and other linguistic tasks that they were typically drilled upon. While this was a very satisfying process as a student clinician, I found out that my clients and their families were far from satisfied with these findings. They continued to report of communication problems in their social lives even though their scores on standardized assessments improved. They often reported significant problems in communicating in the real world that had not changed after months of therapy. Consistent with my clinical observations, several researchers in aphasiology have studied and documented a gap between clinical improvements and functional outcomes in everyday life (e.g. Holland, 1999; Kagan et al., 2008; Simmons-Mackie et al., 2014). Researchers have also documented this disparity in the measure of treatment progress and have recommended the assessment of both *clinical improvement* (using tests of linguistics skills) and *functional improvement* (assessing communicative problems in everyday life). Therefore, my clinical experiences highlight that the impairment-based treatments for aphasia dominate the field due to documented clinical improvements, despite not meeting the social requirements of people, leading to a vast clinical-functional gap. My goal as a researcher is to understand and bridge this clinical-functional gap in

interventions for aphasia. With this goal in mind, I chose to study social-based interventions and to understand the therapeutic principles underlying these methods. This chapter gives an overview of social-based intervention approaches for aphasia, highlighting their importance in research and clinical practice, and also drawing attention to the limited research on several crucial domains in this area.

Social Approaches to Aphasia Treatment

Simmons-Mackie (2008, p. 292) defines aphasia within a social model as *"an impairment due to brain damage in the formulation and reception of language, often associated with diminished participation in life events and reduced fulfillment of desired social roles".* Having their roots in the pragmatic approach and in the social model, social-based interventions have emerged with the aim of improving communication in daily living (e.g., Elman & Bernstein-Ellis, 1999; Kagan, Black, Duchan, Simmons-Mackie, & Square, 2001; Lyon, 1999). Based in part on the International Classification of Functioning, Disability and Health (ICF) model (WHO, 2001), social approaches have a specific focus on psycho-social well-being, social participation, and life contexts, unlike traditional treatments for aphasia which often target the impairment or body structures/functions. In other words, by not viewing aphasia as an isolated linguistic disruption, researchers have designed social approaches to consider the impact of aphasia and its consequences in real life.

In contrast to clinician-centered treatments, Simmons-Mackie et al., (2007) describe social treatments as client-centered and less structured, with clinicians serving as a resource rather than an authority figure, and with discourse structures resembling natural peer communication. Typically, these client-centered social interventions include exchange of novel ideas in individual dialogues, open-ended group discussions, or structured barrier tasks (Hengst et al., 2010; Kempler & Goral, 2011). Simmons-Mackie (2008) outlines the nine principles of a social approach to the treatment of aphasia:

> (a) address information exchange and social needs as dual goals of communication; (b) address communication within authentic, relevant and natural contexts; (c) view communication as dynamic, flexible and multidimensional; (d) focus on the collaborative nature of communication; (e) focus on natural interaction, particularly conversation; (f) Focus on personal and social consequences of aphasia; (g) focus on adaptations to impairment; (h) Embrace the perspective of those affected by aphasia; and (i) encourage qualitative and quantitative measures. (p. 292)

These principles suggest that, unlike the traditional treatment methods which targeted the primary impairments of aphasia for treatment, social-based treatments target social communication skills. There have been numerous attempts to develop such an approach however, only few have been widely cited in the literature (discussed below).

According to Lyon (1992), a pioneer in promoting social approaches to aphasia, optimal management of aphasia extends beyond an anatomic-physiologic basis of dysfunction, and requires extensive treatment to ensure participation in life for PWA. Lyon et al., (1997) studied communication partners as a treatment model for PWA. He trained the communicative partners to engage the PWA in activities of their choice. This consisted of training the PWA and a volunteer for effective interaction initially, and later carrying out activities of PWA's choice at natural contexts. They found improved measures on The CRUI (Communication Readiness and Use Index) and the PKI (Psychosocial Well-being Index). This study was one of the first to highlight the importance of merging clinical and real-life therapies.

The social philosophy for aphasia treatment is also clearly articulated in the Life Participation Approach to Aphasia (LPAA project group, Chapey, Duchan, Elman, Garcia, Kagan, Lyon, & Simmons-Mackie, 2000). This approach grew from the philosophies of the ICF model (WHO, 2001), and it argued for providing support for not only the PWA but to all the people affected by aphasia, and until the support is refused. Although LPAA is grounded in the principles of social model it is a philosophy for managing aphasia and not a treatment method. Therefore, LPAA can only be used as a framework (just like the social model) for generating treatment goals. Therefore, we need further research towards an intervention for implementing the social principles.

The overall goal of the different social approaches to aphasia intervention in the literature has been common: to achieve successful social interactions. However, depending on the treatment method used, the direct target for treatment also varies, including *conversation-based methods* that target the conversation structure (e.g., SPPARC by Lock, Wilkinson, Bryan, Maxim, Edmundson, Bruce and Moir, 2001); *partner training methods* that targets the communication partners (e.g., SCA by Kagan, 1998); *counseling-based methods* that target psychological factors (e.g., Life coaching by Holland, 2007); *compensatory methods* that target multi-modality use (e.g., drawing by Lyon, 1995); and, *group therapies* that target natural conversations (e.g., by Elman and Bernstein-Ellis, 1999).

Conversation-based treatment methods. Lock et al., (2001) developed a conversation training program titled "SPPARC: Supporting Partners of People with Aphasia in Relationships and Conversation" by adapting conversation analysis techniques. This method was based on the theory of experiential learning (Kolb, 1984) which describes learning as a process of reflecting on experiences, conceptualizing the reflections, and finally experimenting with them. The program consisted of three stages: gaining insight into the conversation patterns, understanding them, and identifying and experimenting with options. Although SPPARC stresses the importance of conversation, the mechanism of learning is not explored, and the other life-goals are not emphasized.

In another study, conversation therapy was studied by comparing it with stimulation therapy on two participants with aphasia (Savage, Donovan, & Hoffman, 2014). The conversation therapy consisted of a conversation on a topic of interest with the clinician using strategies such as initiating topics, maintaining turns, and smooth topic changes. Designed as an alternate treatment design, the primary outcome measure was a 6-minute conversation sample, and the secondary outcome measure was a set of standardized tests including WAB, ASHA-FACS. The conversations were measured for *facilitative conversational interactions* (coded as *initiation*, *response*, and *continuation*), and *non-facilitative conversational interactions* (coded as *repair/revision* and *feedback*). Results indicated improved performance in conversations (large increases in facilitative conversational interactions, and large decreases in non-facilitative conversational interactions) after each treatment for both the participants, with the highest gain following the conversation therapy. Secondary outcome measures also showed similar changes with greater differences for conversation therapy than for stimulation therapy. Although the treatment proposed seems to target the social aspects of communication, the authors fail to provide a theoretical support for learning.

Partner training methods. Kagan (1998) designed a treatment based on the philosophy of social participation called Supported Conversation for Persons with Aphasia (SCA). SCA consisted of training conversation partners to help them understand the competence of PWA. The efficacy of SCA was studied by Kagan, Black, Duchan, Simmons-Mackie, and Square (2001), by comparing the scores of trained and control volunteers, on Measure of Skill in Providing Supported Conversation for PWA (M) SCA, at pre- and post- training. They found higher scores on acknowledging and revealing competence by trained volunteers than control volunteers. Also

PWA, who did not receive any training showed a positive change on social rating, and message exchange skills. This study highlights the impact of perception of competence of PWA by society regarding their overall communication abilities. However, this treatment does not directly target communication skills of the PWA.

Counseling-based methods. Based on the principles of positive psychology (Seligman, 2002; Peterson, 2006), Holland (2007) developed the life-coaching approach with emphasis on counseling in aphasia. This approach was designed to establish empathy and to provide information about aphasia and support during the initial phase of treatment. It aimed for living successfully with aphasia, by helping family to get on with life, learning optimism, teaching communication strategies, and learning to use strengths. Worrall, Brown, Cruice, Davidson, Hersh, Howe and Sherratt (2010) conducted three independent qualitative studies to determine the perspectives of the PWA, their families, and their SLPs with respect to their goals and quality of life. They found that living with aphasia takes time, and people with aphasia fit aphasia into their lives. Their findings provided support for the life-coaching approach, and its advocacy as a long term rehabilitation approach for achieving real life goals. While this approach targets psycho-social well-being of individuals, it does not focus or specify any mechanism for improving communication skills.

Compensatory methods. Although compensatory strategies such as writing, gestures, and other augmentative methods have been widely used with PWA, effective communication in everyday lives has not been documented (Simmons-Mackie, 1993). Thus, compensatory methods which focus on natural interactions, dynamic flow of conversation, and better generalization of abilities have been suggested (Simmons-Mackie, 2008). Lyon (1995) describes drawing as an augmentative mode of interaction and suggests it to be used in different social contexts. In more recent times, alternative augmentative therapies have been used as compensatory methods. Compensatory methods definitely form a core part of a social-based treatment, however if solely used they certainly have their limitations.

Group therapies. Elman and Bernstein-Ellis (1999), who have conducted many group-based treatments for aphasia, believe that group therapy for PWA facilitates generalization of functional communication to natural environments, improves participation in life, and provides supportive environment for communication. According to the two researchers, group therapy ensures natural interaction rather than the traditional didactic practice of skills in individual

therapy. A group treatment study on PWA by Elman and Bernstein-Ellis (1999) showed better linguistic and communicative performance on standardized tests post-treatment. They reported that a group environment creates a natural context for conversation, provides more number of communication partners, more natural activities, and seems to be an ideal setting to practice social approaches to treatment. Although this approach seems very promising, the authors have mainly used standardized assessments for measuring treatment progress, and they do not draw support from any theories of learning.

In summary, while traditional treatment approaches (e.g., Schuell et al., 1964; Sparks, 1975; and Shewan & Bandur, 1986) for aphasia focus on identifying impairments in the substrates that support an individual's ability to communicate, and targeting those areas with isolated stimulation and repetition-based drills, social treatment approaches argue for the importance of identifying communication needs of individuals with aphasia, of directing treatments and conversations to address topics relevant to clients' lives, and of drawing on the power of social connections between communication partners to support successful communication (e.g., Lyon, 1992; Kagan, 1998; LPAA Project Group, 2000). The five social-based approaches described above have provided us with different methods to work on clients' functional lives i.e., by conversations, partner training, counseling, group therapies and compensatory methods. However, the following section describes what the existing research on social approaches lacks, and how this dissertation aims to overcome those limitations.

Criticisms on Social Approaches

Unlike traditional treatments for aphasia which often target the impairment or body structures/functions, social approaches to treating aphasia have been directed at disruptions in routine activities and social participation, as well as the personal and environmental factors that interfere with functioning. Social treatment methods by and large have provided evidence for improvements in communication, relationships, social participation, and job performance (e.g., Elman & Bernstein-Ellis, 1999; Holland & Hopper, 1998). However, on a closer look at the existing social-based interventions, two key issues are noted— a lack of a socio-cultural perspective in understanding communication, and a lack of a theoretical support for learning.

Although social approaches have their roots in pragmatism, they have been highly influenced by the neurolinguistic and psycholinguistic theories of language (e.g., Fabbro, 2001; Levelt, 1999). Despite the treatment focus on exchange of new information within a

conversational context using multimodality, many social approaches continue to assume the modular view of language that isolates different components of communication. Such a framework views communication as a network of separate entities that function together in a predetermined way. Duchan (2001, p. 38) calls this an "*information processing template"*, and it is applied for managing other communication impairments as well, such as for motor speech disorders (respiratory, phonatory, resonatory and articulatory subsystems), voice disorders (difficulties in respiration, frequency, and intensity) and so on. Consequently, several social-based interventions (e.g., Elman & Bernstein-Ellis, 1999; Savage et al., 2014) continue to measure treatment effects on structural linguistic tasks, focusing on the language accuracy or language fluency, leading to questionable conclusions about their evidence on functional impacts. These linguistic assumptions do not consider the importance of socio-cultural variables that clinicians and clients bring to a social interaction and how that dynamically shapes the ongoing conversation; the activities that clinician and clients are involved in during a social-based intervention and how personal and/or shared experiences with the activity influences individual participation and engagement in the treatment; and also the importance of personal and/or shared histories of clinicians and clients in successfully participating in the treatments and benefiting from the treatments. Therefore, the existing social-based interventions lack a socio-cultural theory of communication. The distributed communication theory (Hengst, 2015), a socio-cultural theory of communication is discussed in detail in Chapter 2.

Ferguson (1999) in the article '*Learning in Aphasia: It's not so much what you do, but how you do it!*' asserts that the aphasia literature is in dire need of theories of learning that can elucidate the underlying assumptions of treatments designed for individuals with aphasia. She raises important questions like, "why will anyone learn anything from a particular therapy being described?" (p.125). The fundamental principles of social learning theory (Vygotsky, 1978) strongly resonate with the philosophies of social model. The theory's main standpoint is that social interaction precedes development which is captured in the concept of a zone of proximal development (ZPD) and scaffolding. These are closely related terms which refer to modifying the level of support to adjust to the cognitive level of a person (Stone, 1998). In aphasia treatment, scaffolding is applied not only for achieving communicative goals, but also for emotional and social goals. Vygotsky also argued that tools such as speech and writing, initially serve the purpose of communication or mediating social environments, but later internalization

of these tools will lead to higher cognitive skills. Unlike the impairment-based treatments which focus first on the acquisition of isolated or decontextualized skills and then turn their attention to generalization of learned skills, the social approach proposes the use of natural conversations in real life contexts which would help in better social learning. However, this theory has been applied to social treatments for neurogenic disorders by very few researchers (e.g., Duff, Gallegos, Cohen, & Tranel, 2013; Hengst et al., 2010). Therefore, several researchers (e.g., Damico et al., 2015; Hengst et al., 2010) have documented that despite the strongly valid claims by the social learning theory, the existing social-based treatments for aphasia have not applied its principles of learning.

Due to this, I have come to see the need for a social-based intervention that is grounded in a socio-cultural theory of communication and that applies Vygotsky's social theory of learning. That social-based intervention would use socio-cultural spaces to optimize the structure and functions of the individuals with aphasia by reorganizing their language functions in the brain. Therefore, my dissertation is focused on one such intervention (i.e., the barrier treatment protocol; Hengst, Duff & Dettmer, 2010), that is designed to target collaborative referencing, to involve clients in the development of treatment materials, and to promote and capitalize on social learning within rich conversational interactions.

Summary

This chapter highlights the importance of social approaches for aphasia and the need for more research on social approaches to reduce the clinical-functional gap in managing aphasia. Social-based treatments aim for a client-centered approach to management, emphasizing the clients' real-life and social communicative needs including psychosocial elements of life, and take socio-cultural variables into account. Although the existing social approaches work towards gaining better social lives for people with aphasia by individualizing the treatment goals and changing the roles of SLPs, there is less attention paid to the therapeutic mechanism or the theory for learning, and there is a continued influence from the neurolinguistic and psycholinguistic theories of language. Despite striking similarities of the philosophies of Vygotsky's (1978) social learning theory and the social model, researchers of social approaches (Hopper et al., 2002; Kagan, Black, Duchan, Simmons-Mackie, Square, 2001; Simmons-Mackie et al., 2007; Taylor et al., 2014) have not applied this theory to their treatments, or have not investigated how the participants would learn from such social-based treatments. In addition,

existing social-based treatments do not consider the role of socio-cultural variables in communication.

In short, this chapter has identified the following two problems: (i) the lack of a theory of learning to support the existing social-based interventions; and (ii) the lack of understanding of the socio-cultural framework/theory of how communication occurs from a social perspective. This dissertation addresses both of these issues. Specifically, the next chapter details a socio-cultural theory of communication, (i.e., the distributed communication theory; Hengst, 2015), and describes the barrier treatment protocol, as a social-based intervention for aphasia that is grounded in the distributed communication theory and that gains support from the social theory of learning (Vygotsky, 1978).

Chapter 2

Designing Social Interventions with a Distributed Communication Perspective

Human communication, in general, has been taken up for research varyingly by numerous fields such as linguistics, psychology, anthropology, philosophy, literature, and so on. Each of these fields has unique theories about how humans communicate and why. As a field of communication sciences and disorders, our assessment and therapeutic principles are mainly influenced by theories from linguistics and psychology. The lexical processing models for naming (e.g., TRACE, McClelland & Elman, 1986; Neighborhood Activation Model, Luce et al., 1990), the dual route access model for reading (Forster & Chambers, 1973), and Levelt's (1999) language production model are some of the best-known and studied psycholinguistics-inspired theories that are dominating the aphasia literature in terms of both assessment and intervention. With the advent of social approaches, researchers are beginning to question the application of these theories to interventions for aphasia (e.g., Damico, Simmons-Mackie, Oelschlaeger, Elman & Armstrong, 1999; Ferguson, 1999; Holland, 1998; Kagan & Simmons-Mackie, 2007). However, very few researchers are studying the socio-cultural theories and their application to aphasia management (e.g., Hengst, Duff & Dettmer, 2010; Hengst, Duff & Prior, 2008). This chapter discusses (1) the theoretical constructs of distributed communication theory and its significance in the CSD discipline, and (2) designing social interventions for aphasia (specifically, collaborative referencing task), and a brief review of literature.

Taking a Distributed Communication Perspective

In the article *Distributed communication: Implications of Cultural Historical Activity Theory (CHAT) for communication disorders* (2015), Hengst proposed distributed communication as a theoretical framework focusing on language development in children. Following the same line of argument, I propose to take a distributed communication perspective in studying the patterns of communication in adults with aphasia. Grounded in the CHAT theory (e.g. Cole, 1996) and communication theories of practice from sociology and linguistic anthropology (e.g. Goffman, 1981; Irvine, 1996), distributed communication stands in contrast to the philosophies of the field of communication sciences and disorders which Hengst describes to be focused on the study of isolated and decontextualized skills and behaviors with a traditional linguistic perspective. She argues against the study of linear message transmission system and recommends an interactive approach of studying everyday activities and cultural practices, and

multiple communicative resources with specific histories of use. To explain the theoretical framework of distributed communication and to highlight the importance of communicative resources, histories, and activities, Hengst proposed the following three key principles:
1. "*Language and all communicative resources are inextricably embedded in activity*" (p.19).

Describing the central role of activity in communication, Hengst raises questions like 'what are people doing in and with environments?' instead of our field's typical questions like 'what are people saying and how to correct what they say?' Hutchins' (1995) work on distributed cognition has provided a foundation for thinking about distributed communication. Describing the complex functioning of a crew navigating a ship, he details the way people construct 'functional systems' and coordinate with each other to accomplish tasks. Drawing on Hutchins' work, the distributed communication perspective views activity as functional systems, i.e., "the situated, emergent and highly dynamic flow of alignments among people, objects, and environments as people act to achieve varied ends" (Hengst, 2015, p.18). Hengst gives examples from studies on childhood language development (e.g. Hoyle, 1993, 1994) to point to the way children develop understanding of practices (such as turn taking) much before they develop linguistic understanding, how communicative experiences in different social spaces and practices shape the development of communication, and also how children and adults collaborate to communicatively manage and participate in different activities.

Researchers from sociology and linguistic anthropology (e.g. Goffman, 1981; Irvine, 1996) have viewed activities to be the central phenomenon for the analysis of language for decades. Unlike the traditional linguistic theories that focus on single utterances or conversation dyads for analysis and a speaker-listener perspective, Goffman (1981) claims that language is a part of life events that involves all individuals (within a gathering) who contribute to the process of discourse. He defines this social situation as "the full physical arena in which persons present are in sight and sound of one another" and these persons in aggregate are referred to as a *gathering* (p. 136). He also argues that *participation framework* which refers to the "world beyond the speaker that represents the relationship between the utterance and all the participants in the gathering" (p. 137), can offer better insight into the talk than the analysis of an utterance by itself can. Similarly, Hutchins (1995) in his work on distributed cognition and functional systems also argues that, "the proper unit of analysis is not bounded by the skin or the skull. It includes the socio-material environment of the person, and the boundaries of the system may

shift during the course of the activity" (p. 292). Therefore, drawing from Goffman's and Hutchins's work, Hengst (2015) proposed communication to be distributed and embedded in activities. Taking up activities as functional systems, she argues for the analysis to be focused on the activities itself and not on the isolated utterance.

(2) "*Successful communication depends on common ground built up through histories of participation in activities*" (p.19).

Hengst draws from Clark and Wilkes-Gibbs' (1986) work to explain the notion of common ground and its importance in communication. Clark and Wilkes-Gibbs suggest that the linguistic theories (which explain language through models of lexical access, morphosyntactic rules etc.) fail to understand how communication occurs. Instead, their argument is that people express and understand each others' sentences and actions by conducting heuristic searches for possible common grounds. For example, as avid Harry Potter followers, my sister (who lives in Ohio) and I have always had extended discussions about how all the seven Potter movies have been a letdown compared to the novels. A few months back, we both happened to go to *The Jungle Book* on the same day (but in different cities), and we caught the new trailer of *Fantastic Beasts and Where to Find Them*. Being unaware of this film being made, both of us were excited, and we texted each other from the respective theaters at the exact same time: "Did you see it?" for which I said: "Yep, you think it's any good?" and she replied- "Doesn't matter, but I am watching it!" The history of the past interactions with my sister helped me understand pretty quickly that she is talking about the trailer. Even though neither of us ever mentions what "it" is, we still had a successful conversation. Hengst describes such successful communication as depending on "participants' building, recognizing, and drawing on shared histories of participation in activities" (p. 21).

Irvine (1996), a linguistic anthropologist, highlights the importance of histories of participation in activities in her work on "shadow conversations." She presents an example of a form of insult poetry performed at weddings in a rural community in Senegal, Africa to describe shadow conversations. The poems are cleverly worded insults aimed at the bride or any of her family. While these insult poems are composed by high-ranking women of the groom's family, they are usually performed by other low-ranking women. Irvine claims that the insult utterance is a form of shadow conversation because it suggests "the implicit links to many dialogues, not only the present one, which together inform its significance, influence its form, and contribute to

its performative force" (p. 140). She argues that this relationship between the utterance event and the implicated dialogues suggests how people understand the utterance itself and its significance. Therefore, common ground built through such histories of participation in activities or shadow conversations forms the central element for successful communication.

(3) "*Language cannot act alone, but is always orchestrated with other communicative resources*" (p. 19).

The concept of semiotic communicative resources goes back to the works of Voloshinov (1973), who argued that verbal sign as a form of utterance is the most revealing object of semiotic studies, and that verbal signs are most commonly "joined with other types of semiotic manifestation and interchange— with miming, gesturing, acting out and the like" (p. 20). From a distributed communication perspective, Hengst (2015) argues that communication includes not only language, but also other semiotic communicative resources such as gestures, facial expressions, paralinguistics and socio-cultural voices. Talking about the importance of gestures and paralinguistic markers, Goffman (1981) states that—

> The terms 'speaker' and 'hearer' imply that sound alone is at issue, when, in fact, it is obvious that sight is organizationally very significant too, sometimes even touch. In the management of turn-taking, in the assessment of reception through visual back-channel cues, in the paralinguistic function of gesticulation, in the synchrony of the gaze shift, in the provision of evidence of attention, in the assessment of engrossment through evidence of side-involvements and facial expression- in all of these ways it is apparent that sight is crucial, both for the speaker and for the hearer (p. 129-130).

Goffman therefore argues against an analysis of discourse that privileges a single channel of communication (such as oral). He gives several examples of *service encounters* such as exchange of money for services or goods, passing contacts of strangers, negotiation of a crowded passageway etc. that involves complex and coordinated actions among participants with no oral communication but with rich use of gestural and bodily resources. He proposes an analysis of discourse that includes multichannel responses of all the participants present in the physical *gathering*.

Socio-cultural voices are also considered to be a substantial semiotic communicative resource. The socio-cultural voice refers to the "patterns of discourse that signal identity, personality, and stance, patterns that are indexed in particular socio-cultural histories of use" (Hengst, Duff & Prior, 2008, p. 59). Studying the different socio-cultural voices in a clinical setting, Hengst, Duff and Prior (2008) analysed the voices of a clinician and client with aphasia

and amnesia in a collaborative referencing task. They identified an array of voices including typified social voice (indicating professional expertise, family identities and shared interests), re-envoicing (of others' words and acts throughout the interactions), and personalized voicing (evidenced mainly in the client's discourse), thus highlighting the many roles and identities that the clinician and the client displayed within the clinical setting, making it a rich communicative environment.

Another example of how language meanings change with different patterns of communicative resources comes from Goffman's (1981) *footing*. He refers to changes in *footing* or *alignment* as a way of talking about a change in frames or contexts for events. He describes shifts in footing as shifts in participants' alignment towards the task or activity that can be evidenced by a shift in bodily orientation, tone of voice, pitch or any other semiotic means. These footing shifts cause changes in participants' roles in conversation and in the activity, also affecting the individual levels of participation. He also describes how these footing shifts evolve and change dynamically along with the talk and the gathering as part of the activity.

The role of semiotic resources in socio-cultural activities is highlighted in Hengst's collaborative referencing activity using the barrier task, which also displays the patterns of alignments and the participation frameworks (described by Goffman), among participants: (i) The client, partner and moderator are initially engaged in general conversation (not related to the task) while everybody settles down in their assigned seats. (ii) Immediately, there is a shift in the alignment when the moderator takes the platform to give instructions during which the client and partner silently listen and respond appropriately. The partner sometimes helps the moderator set up the barrier boards (with no talk) which is also accepted by the moderator with no talk or sometimes with a "thank you" (an example of a non-linguistic context for utterance or a *service encounter*). (iii) When the moderator leaves the room, the shift in the alignment is displayed by the client or the partner beginning the task with a comment about the first photo-card as they negotiate the roles of director and matcher. (iv) The low-barrier facilitates the use of non-linguistic resources as the client and clinician engage in the collaborative task by the exchange of signs, gestures and facial expressions in addition to the verbal use of language.

In summary, distributed communication takes "a culturally and personally situated, dynamic and critical perspective of communication" (Hengst, 2015, p. 22). Hengst argues to go beyond the structural linguistic analysis of words and syntax, and to focus on the full array of

communicative resources that people embody during communicative activities. She describes the clinical implications of distributed communication by recommending that clinicians flexibly shape and support participation in activities, shift their patterns of alignment to match with the client's, and design collaborative interventions. Clinicians are encouraged to flexibly communicate and help manage clients' participation in different activities, to be highly attentive to specific histories of functional systems, and to identify potential communicative resources within the functional systems and to incorporate them in collaborative interventions that facilitate active participation of clients in specific cultural-historical activities. Within a distributed communication perspective, rich communicative environments can be created in any setting (e.g., a clinical setting) by training clinicians to be skilled and flexible conversation partners. Therefore in this dissertation, I study language interventions from a distributed communication perspective by incorporating collaborative referencing in a barrier task as a social-based clinical intervention for individuals with aphasia. The following section discusses collaborative referencing and its implications for individuals with aphasia.

What is Collaborative Referencing? What are its implications for Aphasia?

Hengst (2003) describes that the term *reference* or *referring* has been taken up by many disciplines including linguistics, psychology, and semiotics, and hence with varying interpretations. From a linguistic perspective, referencing has traditionally been viewed as lexical representations or semantic meanings that link language and the 'real' world literally, and is typically seen in isolation within an individual's lexicon (Saussure, 1959). Therefore, aphasia, specifically anomic aphasia can be characterized with difficulty in referencing or accessing words. Experimental psychologists (e.g. Clark & Wilkes-Gibbs, 1986) view *referencing* as an interactional process that goes beyond semantic meanings (involving *speaker's* meaning) and consists of speakers and listeners engaged in a collaborative meaning making process. Referencing for them is matching the appropriate sign with the target object, or matching up heuristic searches for appropriate shared common ground. Researchers who take a social perspective (e.g. Goffman, 1981; Hengst, 2001; Irvine, 1996) consider *referencing* to depend on the context and the roles of the speaker and listener, making this process "an active, creative and collaborative process" (Hengst, 2001, p. 40). Hengst proposes referencing as the patterns of alignments among participants and mediational resources within sociohistoric spaces.

Psychologists studied referencing in communication by analyzing the changes in speakers' utterances over time depending on the listeners' response, knowledge, context, and social roles (e.g. Clark, 1992; Krauss & Glucksberg, 1969). They developed referential tasks called *barrier tasks* in which speakers and listeners were assigned the roles of 'director' and matcher' respectively, to complete a specific task such as matching pictures to locations, drawing designs on verbal instructions, assembling objects, stacking blocks on a peg etc. The participants were separated by an opaque barrier to allow verbal communication only.

The barrier task was originally used by Krauss and colleagues (Krauss & Glucksberg, 1969; Krauss & Weinheimer, 1964) to study the process of referencing in children as communication partners. The task involved two participants sitting across each other with a barrier completely obscuring their views of each other. Both the participants were assigned the role of a director and/or a matcher. The director gave verbal instructions to the matcher for completing a particular task (e.g. stacking blocks on a peg, or matching a picture to a location). In their studies, Krauss and colleagues designed multiple trials of referencing with the same participants using the same tasks and materials. They consistently found that the referencing expressions simplified and shortened across trials.

The work of Krauss and colleagues has been extended and applied to different disciplines by many researchers (Clark & Wilkes-Gibbs, 1986; Duff, Gallegos, Cohen, & Tranel, 2013; Hengst, Duff, & Dettmer, 2010; Hengst, 2001). Clark, an experimental psychologist was interested in studying referencing, and he identified *mutual common ground* as an important factor for this collaborative meaning making process. According to Clark, speakers and listeners constantly search for a common ground to shape and interpret utterances. He claims that mutual common ground represents peoples' ideas, assumptions, attitudes and knowledge about the world and it facilitates successful communication. Common ground is considered to build up through histories of participation in communicative activities. Clark and Wilkes-Gibbs (1986) state that collaborative referencing entails back and forth play of attempts at conveying the speaker's intention and listener's understanding of the implication by establishing a common ground through shared communicative histories.

To understand the collaborative process of referencing, Clark and Wilkes-Gibbs (1986) used the barrier task. They studied how the speakers and listeners collaborated in developing and using references across six barrier task trials. The participant in the role of director described 12

Chinese tangram cards (abstract black and white shapes) and where to place them on a numbered board to the matcher (who was a stranger to the director). Novel Chinese tangrams were used to study the development of references. They found that referencing expressions shortened and simplified across trials. Based on these findings, Clark and Wilkes-Gibbs proposed the collaborative referencing model, in which they identified three processes in referencing- initiating, refashioning, and accepting the reference. The model postulated that collaboration is a process of back and forth interchange of references which leads to the development of mutual common ground that in turn leads to reduction in the collaborative effort (measured by communicative resources such as words and turns) and successful formation of references. The overt collaboration was measured by calculating the decline in the number of words and turns between the pair in each barrier task trial. They also developed seven categories of initiating referential expressions- elementary, episodic, installment, provisional, placeholder, proxy, and descriptive, and predicted that as the pairs developed common ground, the initiating referencing expressions simplified from descriptive to elementary noun phrases.

Hupet and Chantraine (1992) conducted a study to test whether the effects observed in Clark's study were attributable to the collaboration or mere repetition of the task. They conducted a repeated referential task using the same Chinese tangrams (without an interlocutor physically present) and analyzed the referential behaviors of 16 participants. The interlocutors were made to listen to audio recordings of the speakers' utterances and place the tangram pictures from left to right based on what they hear. Their results showed that the overt collaboration (average number of words produced in each trial, average total time of referring per trial, total number of definite references, and the total number of labels per trial) did not decrease across trials. This finding indicated that continual repetition of the same referential expression made by speakers in monologues do not change across trials as they do in dialogues where interlocutors collaborate to decide upon a reference with minimal effort. The authors concluded that a conversational exchange allows interlocutors to cooperate and build up a common ground for each item to be referred to, and this common ground allows simplification of future references to the same items.

Although Clark's stand on collaborative nature of communication is definitely a step away from the linguistic perspective, this view still lacks the socio-cultural aspects of communication. Hengst (2001) argues that despite Clark's claim that the referential

communication always involves two people, his analysis of referencing suggests a traditional assumption that views language in isolation, with limited focus on social context and communicative resources restricted only to the verbal modality. Simmons-Mackie (2001; p. 292) argues to "focus on the collaborative nature of communication" in designing social interventions for aphasia. As one of the nine principles of a social approach, a collaborative activity shifts the focus from an individual to the collaborative task, to include the communicative efforts of all the speakers involved in the activity. In the next section, I describe a brief review of literature of the collaborative referencing studies conducted on the neurogenic population, starting from Hengst's (2001) study, the adaptation of the research protocol to fit with the socio-cultural theories, followed by research on this adapted research protocol on neurogenic population, and how the research protocol was adapted to be a social-intervention (Hengst, Duff, & Dettmer, 2010) and concluding with my early research project (Devanga, 2014).

Review of Collaborative Referencing Studies in CSD

Hengst's (2001, 2003) social perspective of *referencing* goes beyond Clark's assumptions. According to this view, the difference between reference and the 'reality' are blurred, and they are embedded within social actions. This view of referential communication goes beyond the speaker-listener interaction, and involves patterns of alignment of the participants and different social roles that each participant brings to the interaction (Goffman, 1981; Irvine, 1996). It also involves not just verbal resources, but gestures, postures, object manipulations and proxemics as the mediational resources (Wertsch, 1991). This view also takes into account the dialogicality of language and the individual voices of the speakers, and integrates the social, cultural and historic variables into the process of referential communication.

Hengst and collaborators adapted the barrier task to study referential communication in individuals with neurogenic communication disorders and their routine communication partners. The barrier task adaptation was motivated by the socio-cultural theories and principles, and the research questions. Some of the main adaptations are listed below:

(1). Choosing a routine communication partner/clinician over a stranger: Psychological studies on barrier tasks that used strangers as partners focused only on the factors contributing to completion of the task such as speaker's verbal attempts, listener's perspective and feedback and how that led to the development of concise labels. Motivation for the strangers was also mainly compensation for their participation in the study, and no other personal gain. Substituting

strangers with familiar or routine communication partners for whom communication is a deep life concern and who are in a long-term relationship made the task more motivated and more negotiable, and allowed researchers to study the histories that partners bring to the task, and how that shapes the interaction and the development of labels. Having clinicians as partners led to studying of voices and roles that clinicians carry and how (or if) that affects the interaction and referencing process. Hengst (2001) added a modified basic exchange category in addition to the two-turn basic exchange category of Clark and Wilkes-Gibbs that is a measure of overt collaborative effort. The modified basic exchange category refers to the accurate placement of the card after successful referencing but not within two to four turns, including talk about non-task topics or with no overt collaboration. This new category captured the extended talk between the partners that occurred even after successful collaboration on the target photo-card.

(2). Choosing a low barrier over a complete barrier and encouraging the participants to communicate in any way or means: Hengst (2001) criticizes Clark's design to be too linguistic-based with minimal socio-historic basis for communication, because of the emphasis on verbal linguistic resources. The prediction of the collaborative referencing model was that the pairs develop common ground during the process of referencing which can be evidenced by the simplification of the (verbal) labels from descriptive to elementary noun phrases, and reduction in the use of communicative resources (words and turns). With the low barrier adaptation, evidence for collaborative referencing can be obtained by measuring not just the verbal resources, but also the non-verbal semiotic resources such as the reduction in the number of gestures, drawings, etc. that Goffman (1981) recommends to be included as part of the analysis. Encouraging the participants to communicate in any means would help the researchers to capture the different communicative resources that they choose to use. Thinking along the same lines, Hengst (2001) added another initiating referencing expression category— '*Other'* to the list of seven by Clark and Wilkes-Gibbs (1986). The *Other* referred to a non-verbal initiating referencing expression.

(3). Choosing to alternate the roles of director and matcher across trials, over stagnant roles: Alternating the roles of director and matcher would provide equal opportunities for the development of referencing labels and for the management of the task. Hengst (2003) investigated collaborative referencing in four adults with moderate to severe aphasia and their routine communication partners (spouses or children). The analysis included transcription and

coding systems based on Hengst (2001) and Clark and Wilkes-Gibbs (1986). Five types of communicative resources were identified: words, gestures, time, turns, basic and modified basic exchanges in the interactions. Eight types of initiating referential expressions were identified and coded for each card placement: *elementary, episodic, provisional, installment, placeholder, proxy, descriptive,* and *other*. As predicted by the collaborative referencing model, the results revealed successful collaborative referencing in these pairs despite aphasia, evidenced by the reduction in the use of communicative resources and simplification of referential expressions across trials. A situated discourse analysis also revealed that the participants were able to consistently use the labels of target items without clinician-directed repetition, and also to develop new labels from conversational repetition. The study also revealed patterns of successful referencing that were not reported or observed in Clark's study. The participant pairs used diverse and personalized referential practices, contextualized histories, and verbal play. The appearances of these practices are likely to have occurred because of the social relationship that the communication partners developed and shared with each other.

To study the real world communication abilities and social learning in individuals with amnesia, Duff et al., (2006) examined collaborative referencing in four adults with amnesia (bilateral hippocampal damage and severe declarative memory deficit) and their control group. Based on the literature on amnesia, they initially hypothesized that the amnesic patients would fail to acquire common ground due to their memory deficits and thus would be unable to develop and simplify referential labels over time, and that they would also show poor learning due to impairments in episodic and semantic memories. The participants completed the collaborative referencing task using 12 tangram cards across 24 trials in two days. They were also tested on retention of referential labels outside the barrier task. Despite declarative memory impairments, the participants showed robust learning with the rate of learning equivalent to the control group. Although the amnesic patients were slower and used more words compared to the comparison group, they were still successful at collaboration, showing a reduction in the collaborative effort across trials. The participants also retained the referential labels at 30-minute and 6 month interval testing. The authors conclude by recommending collaborative referencing tasks as an approach for learning in amnesia. They state that unlike errorless learning which taps the preserved procedural memory and has been documented to be beneficial for amnesia,

collaborative referencing depends on declarative memory and yet has shown successful learning that is more similar to real world learning situations, and therefore also has better generalization.

Collaborative referencing has been studied on people with Alzheimer's disease as well. Shune and Duff (2012) analyzed the verbal play in individuals with very mild Alzheimer's and their communication partners, and found creative and successful use of language, highlighting preserved social communication. They highlighted the importance of drawing on such interactionally meaningful communication as interventions for individuals with memory impairments. In another study, Duff et al., (2013) demonstrated learning with increased accuracy and reduced time consumption in five individuals with early stage Alzheimer's disease, which did not differ from learning in healthy comparisons, suggesting high clinical implications. Unlike the implicit-memory driven errorless approach, the neurophysiology in a collaborative referencing approach seems to involve implicit and explicit memory, depending on the task demands.

Inspired from the successful findings from the studies on collaborative referencing in neurogenic populations (Duff et al., 2008, 2006; Hengst & Duff, 2007; Hengst, 2003; Hengst, 2001) Hengst, Duff and Dettmer (2010) adapted the barrier task research protocol as an intervention for adults with communication disorders. Based on socio-cultural theories of communication, the authors identified repetition as a fundamental part of everyday language use, communication and learning. As opposed to the notion of verbatim repetition that is typically followed in impairment-based treatments for communication disorders, they proposed the concept of *repeated engagement* as "a contextual frame of repetition in multimodal forms (speech acts, semiotics, etc), supporting communicative success in different ways" (pp.888-889). The authors observed from previous studies that conversational repetition of labels was common during and between all the barrier task trials and thus accounted for the successful and robust learning of labels to such repeated engagements with labels in the task. BTP tries to overcome the limitations of the traditional approaches (guided repetition or drill) which apply motor learning principles to language intervention, involving the *inflexible* non-declarative memory (Duff et al., 2006). In this method, repeated engagement is considered over verbatim repetition to tap the *flexible* declarative memory for better generalization and social learning. It implements the task of repeated engagement in a naturally occurring conversational interaction which is significantly different from the traditional drill-based therapies. The barrier task as an

intervention draws support from Vygotsky's (1978) social learning theory and from memory research findings for better social learning.

In the initial pilot of the barrier treatment protocol, (Hengst et al., 2010) the research protocol was adapted as a 10-session barrier treatment protocol for an individual with mild aphasia and amnesia and a clinician served the role of the collaborative partner as a routine communication partner did in the research protocol. They also increased the referencing targets from 12 to 30 that included pictures of familiar people, local street intersections and local buildings. At the end of each session, the participant pair were asked for the referential labels that they agreed upon (ATL) for each target. The pair was awarded 1 point for every correctly placed card (12 points/per trial), 1 point for every time they referenced the target with the ATL (possible 12 points/per trial), and 1 point if the matcher repeated the director's label (possible 12 points/per trial). The repetition was enforced to help improve the word finding difficulties in the aphasic patient. They found similar results of successful referencing and learning new labels from repeated engagement. The high number of repetitions of referential labels among both the participants was reported to have been achieved without any clinician-directed repetition. The authors concluded by promoting activities on repeated engagement for everyday learning that allows complex and functional communication as opposed to clinician-directed drill, and by shifting the role of clinicians as leaders or teachers to communicative partners.

Repetition of isolated behaviors such as naming a set of picture cards is usually a traditional treatment goal for individuals with aphasia. Such drill-based learning is interpreted to be engaging the non-declarative memory system which supports individual and isolated experiences that are inflexible, meaning that they can be retrieved only under those specific situations. Repeated engagement, on the other hand, is interpreted to be engaging the declarative memory system, which supports flexible expression of memory in novel situations and easy access to different processing systems (Hengst et al., 2010).

Although studies on collaborative referencing showed that participants with neurogenic communication disorders collaborate successfully with the barrier task and revealed learning of referential labels, their participation in communication outside of the task and impacts of the BTP on their psychosocial well-being were not explored. My early research project (Devanga, 2014) addressed these issues with the aim of investigating the effects of barrier treatment protocol (Hengst et al., 2010) on the communicative abilities of Mr. Lee, the target person with

aphasia, using an interpretive case-study design. The study included Mr. Lee and a clinician as communication partners for the first 10 barrier treatment sessions, followed by Mr. and Mrs. Lee as communication partners for the last five treatment sessions. The study successfully demonstrated collaborative referencing between the participant pairs as predicted by the collaborative referencing model (Clark & Wilkes-Gibbs, 1968). The study also revealed improved conversational support of the partner during the treatment (as measured by *Measure of Support in Conversation* and *Measure of Participation in Conversation*, Kagan et al., 2001) and improved communication abilities of the participant with aphasia outside treatment conditions (as measured by *Communication confidence rating scale for aphasia*, Babbitt & Cherney, 2010); and *Conversational Profile*, based on conversation analysis profile for people with aphasia; Whitworth, Perkins, & Lesser, 1997).

Summary

In summary, the distributed communication theory is set up as a theoretical framework for the current study. The theory's main tenet is that communication and its resources are distributed in socio-cultural and historical activities. The collaborative referencing task within the barrier treatment protocol is also set up with the distributed communication perspective. The adaptation of the barrier task research protocol as an intervention also follows the distributed communication framework. Thus, this chapter provides a socio-cultural theoretical framework for the treatment which is currently lacking in the existing social-based interventions. In the next chapter, I describe the social-based measures for assessing treatment progress and also the research-methodological issues to consider in designing treatment studies.

Chapter 3

Outcome Measures and Research Methods for Studying Treatments

The previous two chapters have illustrated the need for social-based interventions in aphasia to reduce the clinical-functional gap, and the importance of taking a distributed communication perspective in designing such interventions. The next logical steps in this process are to understand how to measure such a social-based intervention in a way that is meaningful for not only the professionals, but also for the patients and their families; and finally, to understand the research-based methodological issues in designing such treatment studies. Continuing the socio-cultural framework from intervention to assessment, the first section of this chapter describes the treatment outcome measures using the ICF model, specifically focusing on the measures chosen to assess the treatment progress in the current study. The second section of this chapter discusses the different research methodologies in the field of communication sciences and disorders focusing specifically on the methodologies employed in this study, (i.e., qualitative/interpretive case-study design and single-case experimental design), their epistemology and rationale, and finally, combining the two methods using the mixed methodologies. The final section of this chapter gives an outline of the current study.

Outcome Measures for Social-based Interventions

One of the focal points of treatment research in aphasia has been treatment outcomes research. In recent years, there has been an increasing push towards efficient and effective healthcare delivery by improving the quality and standards of care. Outcome measures are assessments that choose to test the treatment effects on patients. Kagan and Simmons-Mackie (2007) suggest that outcome measures for aphasia intervention should be tied to each individual's situation and related to life participation in the broadest sense. Assessments and interventions that follow the philosophy of life participation are in turn based on the principles of the ICF model (WHO, 2001). The outcome measures that are used in this dissertation are in line with the ICF's three major components- body structures and functions, activities and participation, and contextual factors.

Body structures and functions. Body structures and functions refer to the anatomic, physiologic and psychological functions of the body structures (WHO, 2001). Within the scope of aphasia, it includes testing of brain's structures and language functions. In this study, I evaluate the participants' language functions and aphasia severity by documenting their

performance on standardized tests such as Boston Diagnostic Aphasia Examination-3 (BDAE-3, Goodglass, Kaplan & Baressi, 2000), and Western Aphasia Battery (WAB, Shewan & Kertesz, 1980). I also use the clock drawing test (Agrell & Dehun, 1998) and the Rey-Osterrieth Complex Figure test (ROCF, Osterrieth, 1944) to rule out any associated cognitive deficits.

Naming deficits are one of the most common characteristics prevalent in all types of aphasic syndromes (Benson & Ardila, 1996; Goodglass, 1980), and naming measures are one of the most documented treatment outcome measures in the aphasia literature (e.g. Fridriksson, et al., 2007; Kiran & Bassetto, 2008; Kiran & Thompson, 2003). Following a social approach, I chose to use a collaborative confrontation naming task (CCN) that involves production of words, phrases and/or sentences by the PWA on presentation of photo-cards, followed by an agreement and/or a collaborative feedback from the partner. Although the CCN is a linguistic-based task, this task is designed differently by keeping in mind the theoretical constructs of the socio-cultural theories: (a) responses that are not strictly oral are accepted as valid responses and considered for scoring; (b) the CCN task is taken up as a functional system for further analysis; (c) the socio-cultural histories of the target participants are considered by selecting personal photographs from their lives as opposed to using a standard line drawing of an object (as in the case of a traditional linguistic-based task); and (d) instead of focusing on the isolated production of names from the client, the responses of the partner (collaborative feedback) and the clinician, are also considered during the assessment of the CCN responses. The CCN task serves to assess naming (one of the vital language functions of the brain), and therefore it forms a core part of the ICF's body structures and functions domain.

The CCN responses are assessed using an adapted Porch Index of Communicative Ability (PICA; Porch, 1971). PICA is chosen because of its multidimensional scoring system that considers five dimensions (including accuracy, responsiveness, completeness, promptness, and efficiency) of patient's responses and quantifies the levels of behavior in an efficient and practical manner. Porch (1971) describes the five dimensions as follows: *Accuracy* refers to whether the response is correct or incorrect, and if incorrect the levels of error can be scored. *Responsiveness* refers to the ability to respond to stimulation. *Completeness* refers to the ability to complete the task in its entirety. *Promptness* refers to the ability of the patient to respond without any delay. *Efficiency* refers to the production of speech, writing or gestures with no distortions. In this study, Porch (1971) included 30 patients with aphasia who were scored on

PICA by three trained speech language pathologists for a task of naming 10 common objects, and the results revealed a high inter-rater reliability with no significant difference between the scores from the three observers ($p<0.05$) along with quantification of behaviors. The reliability coefficients were found to be 0.97 for the response scores. Therefore, this multidimensional scoring system serves as an effective way to score the CCN task in this study.

Activity and Participation. Impairments in the body structures and functions often have an impact on the activities and participation of individuals. From the activity and participation perspective, conversations are the means through which individuals get involved and participate in communicative activities. In aphasia, testing of activities and participation includes testing communicative behaviors in everyday communicative situations, participating in different social settings and henceforth. Some of the sociolinguistic measures of activity and participation chosen for this study includes a measure of conversational synchrony (including the non-content and content semiotic convergence), and a measure of conversation profile (including a patient-report of participation in different communicative activities).

Conversation requires coordination and synchrony from the speakers, in terms of both content and non-content aspects of behaviors (Gordon, Rigon, & Duff, 2015). The Communication Accommodation Theory (CAT) (Giles, 1973), originally known as speech accommodation theory, was proposed to understand why and how people shift their languages and accents during conversations with other individuals. Giles argued that the variability in speech during interactions is centered on the addressee and that it is mediated by interpersonal accommodation processes. Extending into non-linguistic domains, the theory later came to be known as *communication accommodation theory*. Dragojevic, Gasiorek and Giles, (2016) describe the CAT's major tenet as:

> Speakers come to interactions with an initial orientation, which is informed by past interpersonal and intergroup experiences, as well as the prevailing socio-historical context. In interactions, speakers adjust their communicative behavior based on evaluations of their fellow interactants' communicative characteristics as well as their own desire to establish and maintain a positive personal and social identity. Each speaker evaluates and makes attributions about the interaction, as well as about the other speaker, on the basis of their perceptions of that other speaker's, as well as their own, communication. These attributions and evaluations then affect the quality and nature of both the present interaction between these speakers and speakers' intent to engage in future interactions with each other. (p. 3)

CAT suggests different ways in which individuals adjust their speech behaviors in response to the other. These adjustments were conceptualized in terms of *convergence*, *divergence* and *maintenance*. Convergence of speech (or conversational synchrony) has been described as the inclination of the speakers "to adapt their speech in similar directions or toward increased similarity across dyads" (Street, 1984, p. 140). Divergence refers to "adjusting communicative behaviors to accentuate verbal and nonverbal differences with others, to appear more dissimilar" (Dragojevic, Gasiorek & Giles, 2016, p. 4). Convergence and divergence can occur on different variables such as language, accent, number of words per turn, and henceforth. Maintenance refers to "sustaining one's default way of communicating without adjusting for others" (Dragojevic, Gasiorek & Giles, 2016, p. 4).

Studies have shown that speech convergence facilitates conversational interaction and allows speakers to have positive impressions despite their unawareness of the similarities (Cappella & Planalp, 1981; Street, 1984). In a study by Gordon et al., (2015), conversational synchrony was assessed on people with traumatic brain injury (TBI) and controls, by evaluating if the words and words per turn became more similar over time (non-content speech convergence) using a 10-minute conversation sample. The ventromedial prefrontal cortex, the most common site of lesion in TBI, has been found to be a critical component of a neural network involved in conversational synchrony (Gordon, Tranel & Duff, 2014). The results indicated that people with TBI did not show conversational synchrony owing to their social communication impairments, but conversational synchrony was observed in the control group.

In the present study, I chose the measure of conversational synchrony as one of the exploratory assessment measures because it provides a platform to explore and understand the complex communicative deficits between two individuals that occur in the real world rather than examining the isolated speech/language behaviors of a single individual. Assessment of conversational synchrony is unprecedented in aphasia literature and it provides us with a deeper understanding of the ways in which individuals with aphasia and their partners collaborate and co-construct the conversation together. Although turn duration, speech rate, response latency, and vocal intensity have been used as measures of non-content speech convergence (Street, 1984), I use words and words per turn because these measures have been studied on individuals with neurogenic communication disorders. I also include gestures as a part of non-content based

measures to continue to align with the distributed communication perspective and to meet the needs of the individuals with aphasia.

Content-based convergence has been studied much less and has mainly been focused on measuring development of topics, shifts in topics and so forth (Jones, Gallois, Callan, & Barker, 1999). Taking a distributed communication perspective, I chose to use interactional discourse resources (IDR) as the main variable in assessing the content-based conversational synchrony. Previous studies of conversational interactions in aphasia, TBI, and amnesia have focused on different discourse resource types that the primary participants and their communication partners draw on during their collaborative act of conversations. These discourse resource types include playful episodes (e.g., Duff, Hengst, Tranel & Cohen, 2009; Hengst, 2006), conversational narratives (e.g., Hengst & Duff, 2007), procedural discourse (e.g., Duff et al., 2008), and conversational repetition (e.g., Erickson, Hengst & Duff, 2008; Hengst, Duff & Dettmer, 2010; Tannen, 2007), all of which essentially serve as rich interactional frames. *Playful episodes* are described as any forms of verbal play that elicits a laughter response from the listener; *conversational narratives* refer to the narration of events that are displaced from the current time; *procedural discourse* refers to the speaker, as an expert, describing a procedure in a series of steps; and *conversational repetitions* are revisions or repetitions of a word or idea, within three interactional turns.

In a study by Hengst, McCartin, Valentino, Devanga, & Sherrill (2016), IDRs were used to conduct discourse analysis on six participants with varying communication disorders requiring assistive technologies in different conversational situations. The results showed that repetitions or reformulations dominated the discourse, which was interpreted as one of the means to avoid breakdowns. The IDRs were able to capture a better picture of their everyday interactions and the roles of their caretakers as mediators, thus highlighting the importance of such close discourse analyses for making decisions about the augmentative alternative devices for these individuals.

In the current study, IDRs are coded and analyzed during the conversational interactions between the target participant and clinician. Similar to using words and gestures as variables to assess non-content based convergence, IDRs are used as a variable to measure the content-based convergence. By using IDRs, I am able to better understand the communicative interactions in people with aphasia and the collaborative nature of conversations in the real world.

To analyze the communicative participation in different settings, assessment techniques of discourse analysis have been developed. Conversation analysis is a popular technique to examine collaborative repair and turn taking abilities. The Conversation Analysis Profile for People with Aphasia (CAPPA) (Whitworth et al., 1997) is a method of assessing the conversation partners' perception of aphasia and the strategies employed. It employs conversation analysis methods to track changes in conversation styles which provide evidence of life participation. Ross, Winslow, Marchant and Brumfitt (2006) studied the impact of a social model approach on communication, life participation, and psycho-social well-being using CAPPA, Hospital Anxiety and Depression Scale (HADS) and Visual Analogue Self-Esteem Scale (VASES) in adults with chronic aphasia. They documented significant changes in the conversation abilities related to life participation using CAPPA.

Historically, interviews, diary studies, and pencil-paper based questionnaires have been the primary method for collecting self-reported data. Based on the ICF model, Patient Reported Outcome (PRO) measures are grounded in the social-based philosophies and have been increasingly used across medical settings. The U.S. Food and Drug Administration (FDA, 2009) defined PROs as "a report of the status of a patient's health condition that comes directly from the patient, without interpretation of the patient's response by a clinician or anyone else". Therefore, in this study, I adapt CAPPA to use it as a PRO measure to examine the perceptions of the person with aphasia about changes in his conversation styles, situations, people, and other outside-treatment conditions, so that the patients' perspectives regarding treatment effects can be assessed.

Contextual Factors. Contextual factors include environment and personal factors that are associated with the health condition. In aphasia, communication can be affected depending on several environmental factors such as the social situation, person familiarity and so on. The psychosocial elements such as personal identity, attitudes, and feelings have been measured as contributing factors for improved quality of life. Communication confidence is a psycho-social element that is relatively less studied although levels of confidence have been documented to show significant lifestyle changes (Cherney, Halper, Holland & Cole, 2008). According to Cherney et al., (2008), communication confidence has been considered as a separate characteristic of the Temperament and Personality functions in the ICF model, and it is defined as "the mental functions that produce a personal disposition that is self-assured, bold and

assertive, as contrasted to being timid, insecure and self-effacing" (Cherney, Babbitt, Semik & Heinemann, 2011, pp. 728). Communication confidence has also been found to be consistent with the principles of the life participation approach (LPAA Project Group, 2000). Researchers have reported that aphasia leads to social isolation which can affect the individual's quality of life, and greater communication confidence is predicted to improve the perceptions of quality of life (Parr, Byng, & Gilpin, 1997; Cherney, Babbitt, Semik & Heinemann, 2011). According to Babbitt and Cherney (2010) communication confidence is tied with autonomy, and participation in life activities (see Figure 3.1).

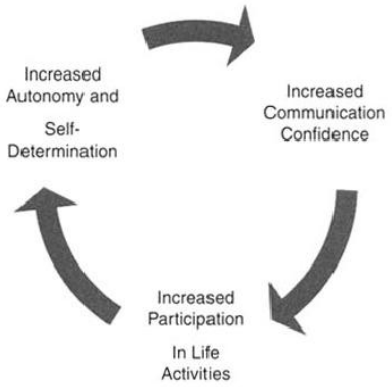


Figure 3.1. Interaction of communication confidence, autonomy and self-determination, and participation in life-activities (Source: Babbitt & Cherney, 2010).

In a study by Van der Gaag et al., (2005), people with aphasia who participated in community-based aphasia centers were interviewed. The PWA reported improved communication confidence, and independent participation in the community activities. To systematically analyze the changes in confidence, Babbitt and Cherney (2010) developed the Communication Confidence Rating Scale for Aphasia (CCRSA) by adapting the ASHA-Quality of Communication Life (ASHA-QCL) (Paul, Frattali, Holland, Thompson, Caperton & Slater, 2004). Inspired from the Self-Efficacy Scaling for Adult Stutterers (SESAS) (Ornstein & Manning, 1985), the CCRSA was a 10-point rating scale, and included questions on confidence to talk to people, understand others, talking in different situations and self-perceptions. Babbitt and Cherney (2010) conducted a study to investigate improvements in communication confidence in PWA after a computer-based treatment protocol by administering CCRSA. Interviews of PWA post-treatment revealed improved participation and confidence, although no significant change in language scores was documented. The psychometric analysis of CCRSA has also shown positive results about its use as a self-rating tool for communication confidence

in aphasia (Babbitt, Heinemann, Semik, & Cherney, 2011). In this study, CCRSA is used as a patient-reported outcome measure of psychosocial factors in PWA to track changes in communication confidence with the treatment.

In summary, the four outcome measures (CCN, conversational synchrony, adapted CAPPA, and CCRSA) fit with the ICF perspective on health, and are selected so that we can better understand the progress made by the patients on both clinical and functional tasks. However by employing these outcome measures, we are, in fact, mixing research methodologies. The next section discusses the issues related to two specific research designs— qualitative interpretive case-studies and quantitative single-case experimental studies, and how and why we combine them.

Qualitative Research: Interpretive Case Study Design and Aphasia

Qualitative research designs have traditionally been used in anthropology, linguistics, social sciences, education, and more recently in the field of communication sciences and disorders. According to qualitative researchers (e.g., Brinton & Fujiki, 2003; Damico, Simmons-Mackie, Oelschlaeger, Elman, & Armstrong, 1999), the aims of a qualitative study are to describe and understand social phenomena and their meanings in participants' lives, which involve gathering, analyzing and interpreting data about individuals, societies or phenomena in their own natural settings. According to Damico and Simmons-Mackie (2003), qualitative research designs in speech-language pathology encompass different methodologies including ethnographies, conversation analyses, phenomenologies, grounded theories, biographical studies, case studies, interviews, surveys and other ethnographic methods.

According to Mertens (2014), qualitative research designs grew from the theories of constructivism which claimed that reality and knowledge are socially constructed by people involved in the research and lived experiences of these people should be understood from their point of view. These theorists follow a personal and interactive mode of data collection with the assumption that interpretations and outcomes are rooted in the context and people apart from the researchers. Validity of the interpretations is increased by documenting multiple sources of data and multiple methods of data collection. Qualitative research designs focus on observations of individual cases and context-specific realities, with the aim of building a theory.

Damico and Simmons-Mackie (2003, p. 132) define qualitative research as "*a variety of analytic procedures designed to systematically collect and describe authentic, contextualized*

social phenomena with the goal of interpretive adequacy". They explain this complex definition in parts as follows: a *variety* of procedures refer to the different data collection and analysis procedures, each of which is *analytic* in nature involving explanation of the patterns of behavior under study; *authentic* and *contextualized* refer to the study of phenomena in their natural settings (because of the context-dependency of behaviors) in order to study the factors that influence the phenomena; *social* phenomena refer to the study of the nature of human social behavior; *systematically collect* refers to careful designing of data collection methods with a rationale; *describe* refers to descriptions of phenomena for interpretations and analyses of patterns under study; and *interpretive adequacy* refers to the ultimate goal of qualitative research which is to describe and explain the social phenomena and its meaning situated in the context. They also explain four criteria for qualitative research designs:

> (a) research should be oriented towards social phenomena that are meaningful for the human society; (b) research procedures should be designed in authentic and natural settings so that the factors that influence a behavior can be studied in detail; (c) the data collection methods should be systematically and carefully planned and executed with a rationale that supports the tradition of research; and (d) using actual descriptions of the behaviors such as discourse markers, in addition to the use of numerical results in order to capture the complex nature of social phenomena. (p. 132-133)

Although the purpose of qualitative research designs are mainly to "describe a social phenomenon and its meaning in the participants' lives, and by extension, in the overall scheme of social activity" (Damico & Simmons-Mackie, 2003, p. 133), there are many ways in which this is accomplished: examining social events to study how particular activities are developed (e.g. examining conversations of individuals with aphasia to study how communication breakdowns occur), and to study how variables interact and create social phenomena (e.g. studying conversations of individuals with aphasia in different settings and analyzing what contributes maximally to breakdowns) (Damico, Oelschlaeger, & Simmons-Mackie, 1999; Damico & Simmons-Mackie, 2003; Simmons-Mackie & Damico, 1999). In all of these conditions, the researcher's role is to learn and understand the complex social phenomenon as opposed to the role of a tester (testing a hypothesis) typical of quantitative methods.

Brinton and Fujiki (2003) identify three hallmarks of qualitative research: *naturalistic data collection*, which are non-manipulable contexts used to extract those behaviors that rarely occur in laboratory settings, *triangualtion* which refers to multiple views of the same phenomenon (using multiple methods, researchers, data sources, or disciplines) to procure a

thorough and reliable understanding of the phenomenon, and *saturation* which refers to collecting data until no new information is obtained (e.g. probing a behavior in different settings and multiple times until no new behavior is displayed).

According to Damico et al., (1999), despite the different traditions of qualitative research, the most common data collection procedure is the audio and video recording of naturalistic behaviors by observations, on-site recording and documentation of behaviors, ethnographic interviews (to gather informants' perspectives), artifactual analysis (studying the objects participants use in relevant contexts), verification of data from other sources, and researcher's experiences. The chief feature of data collection procedures in qualitative research unlike quantitative methods is the flexibility to adjust the procedures to fit the needs of research in order to study and analyze the complex nature of the social phenomena. However, these adjustments require consistent and thoughtful decisions and justifiable rationale. Camic, Rhodes and Yardley (2003) suggest that qualitative data collection is detailed and very comprehensive, which enables the analysis of a phenomenon in multiple ways, even on a single case. They also state that multiple analyses of different aspects of phenomena will lead to the development of multilayered interpretations.

As researchers are beginning to see the value of life participation goals and psychosocial well being of people with aphasia, the need for qualitative studies in aphasia literature is starting to grow. Damico and colleagues (1999, p. 653) describe that unlike quantitative research, qualitative research offers opportunities for researchers to "adopt a learner role" (understanding the social phenomenon under study) rather than "a testing role" (testing a hypothesis), to understand '*how'* questions (e.g. "*how do PWA communicate in real life*?"), rather than '*why'* questions (e.g. "*why do PWA have communication difficulties*?"), to focus on the "individual or the dyad" rather than a large group, to provide thick and detailed descriptions of the complex social phenomenon under investigation, and to describe and understand the "mundane" everyday activities to get to the roots of the social life of these individuals. These questions cannot be answered by using a controlled experimental design because of its rigid and inflexible nature. Cole (1996) suggests creating experimental tasks appropriate for the research questions based on every day practices rather than formal laboratory task with minimal relation to real-life contexts.

Interpretive case studies have had a long history in the qualitative research area, and are employed most widely by social science researchers, education researchers and researchers from

the field of speech language pathology. Damico and Simmons-Mackie (2003) describe case studies to consist of investigations with a specific focus on the object of inquiry, a person, topic, or an event. They describe that the case studies are required to have a clearly specified object of inquiry, data should be specific to the object of inquiry, the study should be conducted within a short period of time (less than one or two years), and the study should provide specific conclusions. These are some of the features that distinguish case study methodologies from other qualitative research methods such as biographies or grounded theories.

A review of the aphasia literature from 1993 to 2013 was undertaken to identify the general patterns of qualitative research in aphasia by Simmons-Mackie and Lynch (2013). Out of 925 articles initially identified as qualitative studies, 78 articles met the review criteria and were considered for further analysis. The results revealed that the number of qualitative research increased from 6 articles published between 1993- 1997, to 45 articles published between 2008-2012; the most common topic of research was the experience of aphasia (n=20; included family reports on quality of life, identity, and psychosocial adjustment), followed by activities and participation (n=17; included communication activities, and participation in relationships); participants were mainly PWA (n=54) followed by family members and carers (n=17); the most common data analysis was qualitative content analysis (n=15; involved identifying content units, coding, categorizing, and aggregating into a theme) followed by thematic analysis (n=11; identifying themes).

There are two other qualitative case studies that are particularly important for the current study. The preliminary study on barrier task (see Hengst, 2003) was an interpretive case study of four individuals with aphasia and their communication partners. This study utilized discourse analysis measures to study collaborative referencing (Clark & Wilkes-Gibbs, 1986) in these individuals and their routine communication partners. Another case study was the adaptation of the barrier task as a treatment (see Hengst et al., 2010) which also used discourse analysis measures and showed successful collaborative referencing in individuals with aphasia.

In this study, I employ an overarching interpretive case study design because my research questions are focused on understanding the changes in the communicative experiences of individuals with aphasia in their everyday lives. This complex social phenomenon is difficult to study with a quantitative design requiring rigorous control of variables and experimental manipulation of treatments. The interpretive case study design provides an opportunity for me to

understand the *process* of communicative change rather than just the *outcome*. The contextual variables are not controlled, but they are central for data analysis. Lyon (1999), in support of the growing case studies and qualitative methods in the communication sciences and disorders' literature states that, employing these methods means that we are:

> Eliminating the non-generalizable clinical notions by first looking for and incorporating reasonable ways that people confronting aphasia already are coping with daily life, seeking more natural adaptations that may add notably to quality of life, seeing, assessing, and working with real life treatment targets from early on in therapy rather than as an afterthought, and circumventing the issue of generalizability of clinical conditions by enacting change in the very form and place and under the very conditions, where generalization is sought. (p. 690)

Therefore, I chose interpretive case-study design to delve deeply into the social lives of participants with aphasia by using ethnographic (observations, interviews and patient-report measures) and discourse analysis methods (collaborative referencing and conversational measures) to assess if and how the treatment affects their real-life communication profiles.

Single-Case Experimental Designs (SCD) and Aphasia

According to Horner et al., (2005), SCD research is a scientific methodology used to define the basic principles of behavior and establish evidence-based practices. They are adaptations of interrupted time-series designs and can provide a rigorous experimental evaluation of intervention effects. SCD researchers (e.g., Horner et al., 2005; Kratochwill et al., 2010) describe that the purpose of SCD methodologies is to document relatively local or immediate cause-effect chains, referred to as *functional relations* between dependent and independent variables by employing within-subject and between-subject controls for maintaining internal validity and systematic replication of data for external validity (Horner et al., 2005). SCDs use individual's baseline behavior as a control (instead of using a control group) and compare with their behavior under treatment conditions. These types of designs involve systematic measurement of a dependent variable before, during, and after the active manipulation of an independent variable, which is usually an intervention (Kratochwill et al., 2010). Multiple baseline designs are a type of SCDs that examine the effect of a treatment by introducing it to different baselines (e.g. behaviors, persons or settings) at different points of time. Treatment effects are determined if the baseline changes if and only when the treatment is introduced.

SCD research designs have developed from the philosophies of behaviorism and applied behavior analysis (ABA) (Skinner, 1976), whose goal was to predict or control behaviors using

explicit and/or implicit principles of verifiability. ABA is a clinical discipline that applies the principles of learning and behavior to solve problems of high social relevance. ABA researchers (e.g., Baer, Wolf, & Risley, 1968; Fisher, Piazza, & Roane, 2011) have identified seven dimensions of ABA: (a) *applied:* using variables that are effective in improving the behavior under study; (b) *behavioral*: examining those directly observable behaviors (not relying on indirect measures of behavior) that are socially important rather than convenient for study, in their usual social settings as opposed to laboratory settings; (c) *analytic*: demonstrating a functional relation between the intervention and the target behavior using controlled single-case designs; (d) *technological*: detailed description of the procedures and techniques used in the experiment that leads to the occurrence or non-occurrence of the target behavior, in such a way that the study can be replicable to a reader; (e) *conceptual systems:* using empirically validated basic behavioral principles in interventions for the analysis of target behaviors; (f) *effective*: evaluating the effects of the intervention or behavioral techniques by visual inspection, and determining the social significance of the effects; and (g) *generality*: transfer of the behavioral changes to different environments, other related behaviors and sustainability over time.

SCD research is used across several disciplines including general and special education, communication sciences and social sciences (Baer et al., 1968). Horner et al. (2005) and colleagues state that operant principles of behavior have been empirically demonstrated and replicated using SCDs for more than seventy years. However, they also state that research methodologies based on diverse theoretical approaches to human behavior can be evaluated within the confines of SCD. Interventions derived from social learning theory, medicine, social psychology, social work and communication disorders have been listed as a sample of procedures that have been analyzed using SCDs.

Unlike traditional descriptive and interpretive case studies, SCDs offer experimental control for establishing causal relations. Therefore, similar to randomized control group designs, SCDs have been used to establish evidence-based practices (e.g., Shavelson & Towne, 2002; Horner et al. 2005). Horner and colleagues (2005) identify nine critical features of the SCDs: (a) individual participant as a unit of analysis; (b) participant and setting description (operational descriptions of the participant, setting and process); (c) dependent variables (operationally defined to allow valid and consistent assessment of the variable, and replication of the study); (d) independent variable (operationally defined, actively manipulated, and with high fidelity); (e)

baseline condition (measurement of the dependent variable during a baseline until the observed pattern of responding is sufficiently consistent to allow prediction of future responding); (f) experimental control (demonstrated when the design documents three demonstrations of the experimental effect at three different points in time with a single participant/within-subject replication, or across different participants/ inter-subject replication); (g) visual analysis (involves interpretation of the level, trend, and variability of performance occurring during baseline and intervention conditions; level refers to the mean performance during a condition of the study; trend refers to the rate of increase or decrease of the best-fit straight line for the dependent variable within a condition; and variability refers to the degree to which performance fluctuates around a mean or slope during a phase). Beeson and Robey (2006) offer an alternative to visual inspection and for the use of inferential statistics, by arguing for the use of standardized effect size as a means for assessing change. An effect size is simply a quantity that characterizes the degree of departure from the null state, which, in this case, is the degree to which a treatment outcome differs from zero; (h) external validity (enhanced through replication of the effects across different participants, different conditions, and/or different measures of the dependent variable); and (i) social validity (selecting socially important dependent variables, demonstrating the application of the intervention with fidelity in typical environmental settings, and demonstrating the interventionists' reports on interventions to be acceptable, feasible, effective and sustainable without the intervention procedure).

There are many types of SCDs including withdrawal or reversal designs, multiple baseline or multiple-probe designs, and alternate treatment designs. According to Kratochwill et al., (2010), withdrawal designs (e.g. ABA, ABAB) evaluate treatment effects by observing the changes in behavior in conditions of no treatment (A) and treatment (B). Multiple baseline designs are similar to withdrawal designs but are employed when the target behavior is irreversible or cannot be reversed for ethical reasons. The evaluation of treatment effects in multiple baseline designs is by observing changes in the target behavior as a consequence to the introduction of treatment. According to McReynolds and Kearns (1983), multiple-probe designs are different from multiple baseline designs with respect to the introduction of probes at strategic points of time to avoid adaptation.

In order to meet evidence standards, Kratochwill et al., (2010) has established the following SCD criteria: (a) the independent variable must be systematically manipulated, with

the researcher determining when and how the independent variable conditions change; (b) each outcome variable must be measured systematically over time by more than one assessor, and the study needs to collect inter-assessor agreement in each phase and on at least 20% of the data points in each condition (e.g., baseline, intervention) and the inter-assessor agreement must meet minimal thresholds; (c) the study must include at least three attempts to demonstrate an intervention effect at three different points in time or with three different phase repetitions; and (d) for a phase to qualify as an attempt to demonstrate an effect, the phase must have a minimum of three data points— (i) to *Meet Standards* a multiple baseline/probe design must have a minimum of six phases with at least 5 data points per phase; (ii) to *Meet Standards with Reservations* a multiple baseline design must have a minimum of six phases with at least 3 data points per phase; and (iii) any phase based on fewer than three data points *cannot* b*e used to demonstrat*e existence or lack of an effect.

Researchers are beginning to use SCDs to study treatments for aphasia. The following three review studies of SCDs in aphasia literature highlight the nature of design implementation, issues in accuracy and reliability, and ways to improve these methodological flaws. In a meta-analysis of SCD research in aphasia literature by Robey, Schultz, Crawford, and Sinner (1999), 63 articles were selected from notable journals during the 1980s to 1990s for review. They found that single-subject aphasia-treatment studies are mostly hypothesis driven. 49 of the 63 studies tested one treatment and included multiple baseline controls or withdrawal controls. The meta-analysis revealed that the visual inspection of the single subject data do not produce reliable results. Therefore, quantifiable analyses and effect sizes are recommended to be used for producing treatment evidence.

In Thompson's (2006) review, 40 SCD articles were selected from popular journals between 2000 and 2005. She found these studies to have vague descriptions of treatments leading to poor replicability, lacking control groups leading to questionable reliability of findings, highly variable profiles of patients leading to inconsistent recovery patterns, and unsuccessful experimental control. She recommends careful selection of participants, precise descriptions of treatments, and gathering reliability measures on outcome measures.

Beeson and Robey (2006) evaluated the SCD treatment research in aphasia literature by presenting an approach to analyze the single subject data by quantifying the treatment outcomes using effect sizes. They reported that visual analysis of SCD data can be reliable when the

treatment effects are large, and there is increased possibility of false positives or Type 1 errors. They suggest the treatment effect size calculation as an alternate approach to measure changes in performance. This approach offers a means to evaluate new treatments, provide evidence base and assist in meta-analysis of treatments.

The aphasia literature on SCD research is dominated by impairment-based treatments (e.g., del Toro et al., 2008; Greenwood, Grassly, Hickin, & Best, 2010; Rose, Douglas, & Matyas, 2002; Thompson, Shapiro, Kiran, & Sobecks, 2003). There are only a handful of social-based treatment studies that use the SCD. One such study was done by Holland and Hopper (1998) to assess the treatment and generalization effects of situation-specific training program on PWA for better communication in simulated emergency situations. This program involved teaching of a small set of specific responses related to a functional situation. Two persons with Broca's aphasia were involved in the experiment which consisted of a baseline session, followed by ten treatment sessions and a treatment probe after one month for maintenance. Situation-specific training consisted of the participants dialing 911, and describing a picture of emergency (spontaneously/on cueing/ repeating) and engaging in a role play of the same emergency. The analysis was based on the listeners identifying the emergency being described by the participants. The results revealed that the training was effective within ten sessions, displaying varying levels of generalization with good maintenance effects. This study design does not meet the criteria for evidence standards (Kratochwill et al., 2012) as the treatment effect is demonstrated on only two participants.

In another study (Hopper et al., 2002), conversational coaching (teaching communication strategies to PWA and their spouses) was tested on two participants with aphasia and their spouses using a multiple baseline design. The main dependent variable was the number of concepts successfully communicated during conversational tasks, which increased after the initiation of conversational coaching in both the participants. Other pre/post measures such as CADL-2 scores also improved post-treatment. This study design does not meet the criteria for evidence standards (Kratochwill et al., 2012) as there is no maintenance phase, and the treatment effect is demonstrated on only two participants.

More recently, a single subject AB1AB2A design was employed to compare stimulation therapy and conversation therapy on two participants with aphasia (Savage et al., 2014) by analyzing a 6 minute conversation sample. The conversations were measured for *facilitative*

conversational interactions (coded as *initiation*, *response*, and *continuation*), and *non-facilitative conversational interactions* (coded as *repair/revision* and *feedback*). Both the participants showed improved performance in conversations (large increases in facilitative conversational interactions, and large decreases in non-facilitative conversational interactions) after each treatment. However, the gain was highest following conversation therapy. This study design also does not meet the criteria for evidence standards (Kratochwill et al., 2010) as the treatment effect is demonstrated on only two participants.

In the current study, I chose to embed SCD as a part of the bigger interpretive case-study methodology to answer some of my specific research questions regarding immediate cause-effect relations between the treatment, and naming and conversational behaviors. The embedded SCD also let me triangulate the findings. In addition, unlike other quantitative methodologies, SCDs allow individual subjects to serve as their own controls, without having to have a large sample size. More specifically, I chose multiple-probe design over other SCDs such as alternating treatment design (serves to compare two treatments) or changing criterion design (serves to demonstrate treatments effects by matching changes in the behavior to a pre-determined criterion), because my research question pertains to demonstrating treatment effects across participants with aphasia and multiple-probe design let me introduce treatments to different individuals at different points in time. Unlike multiple baseline design, multiple-probe design allows me to have probes at strategic points of time without having a prolonged baseline leading to adaptation or learning effects. Therefore, in the current study, I employ a multiple-probe design (across individuals) to determine the effects of the barrier treatment protocol (Hengst et al., 2010) on naming and conversational behaviors on three participants with aphasia. Within the controls of SCD, effects of the treatment are evaluated by examining whether the baseline changed when and only when the treatment is introduced. To meet evidence standards, I included a minimum of three opportunities for demonstrations of treatment effects at three different points of time, with at least five data points in baseline, treatment and maintenance phases.

Mixed Methods Research and Aphasia

The rationale for the emergence and use of mixed methods research is the existing individual differences and limitations of the quantitative and qualitative research designs. Comparing the quantitative and qualitative research designs, researchers (e.g., Wheeldon & Ahlberg, 2011; Johnson & Onwuegbuzie, 2004), state that quantitative research targets

generalizability by controlled experiments that test hypotheses by a process of falsification, focusing on sample size and statistics, while ignoring the complexity of human behavior and the role of context. The major characteristics of quantitative research are "deduction, confirmation, hypothesis testing, explanation, prediction, standardized data collection, and statistical analysis" (Johnson & Onwuegbuzie, 2004, p. 18). On the other hand, qualitative research seeks to understand socially constructed realities by observing and analyzing social interactions, stories and narratives, and experiences, while acknowledging their own biases with the ultimate goal of developing theories. Wheeldon and Ahlberg (2011) however, describe that the researcher bias poses a threat to objectivity that quantitative researchers believe in. The main features of qualitative research have been explained as "induction, discovery, exploration, hypothesis generation, researcher as the primary instrument of data collection, and qualitative analysis" (Johnson & Onwuegbuzie, 2004, p. 18). Unlike qualitative researchers, positivists believe quantification to truly capture the reality under study. But quantitative studies have limitations with respect to their underlying assumptions which when used as evidence would mask the "error-laden process of measurement", and "arbitrary basis for interpretation of inferential statistics" (Camic, Rhodes & Yardley, 2003, p. 36). Thus, researchers have suggested the use of both quantitative and qualitative information in research.

Mixed methods offers to combine these two approaches to understand reality and develop knowledge, because it values both the methods and their roles in answering different research questions. In addition, mixed methods offer researchers an alternative option apart from either/or choice between quantitative and qualitative designs. In a more practical sense, while quantitative research requires larger samples and qualitative research requires smaller samples, mixed methods design offers flexibility for researchers depending on their research questions. According to Wheeldon and Ahlberg (2011), instead of starting from theories to testing, or starting from observations to building theories, mixed methods researchers can view and understand both of these processes within one research. Johnson and Onwuegbuzie (2004, pp. 17) defines mixed methods research as "the class of design where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a study". They state that the fundamental principle of mixed methods research is to collect multiple data using different approaches leading to "complementary strengths and non-overlapping weaknesses" (p. 18). It uses a practical and outcome-oriented method of

investigation, using multiple methods of data collection and analysis to achieve a better understanding of the phenomenon at hand.

Describing the construction of mixed methods designs, Meissner, Creswell, Klassen, Plano, and Smith, (2011) discuss three different approaches: *merging, connecting* or *embedding* data. Quantitative and qualitative data are *merged* to answer specific research questions and to compare the findings [for example, reporting quantitative data (in the form of numerical tables and statistical values) followed by qualitative data (in the form of texts or themes), to support quantitative results]. Mixing designs by *connecting* data (also known as sequential mixed design) involves using qualitative/quantitative data to inform the subsequent data collection (for example, using quantitative survey data to develop qualitative interview materials). Mixing designs by *embedding* data involves embedding a design within a larger primary design. For example, using a larger quantitative design to test a hypothesis with an embedded qualitative method of data from participant interviews.

In aphasia treatment literature, mixed methods designs are relatively low, but are beginning to grow (e.g., Clarke, 2009; Hamilton, McLaren, & Mulhall, 2007; Koops & Lindley, 2002). In a study by Hamilton, McLaren and Mulhall (2007), semi-structured interviews and focus groups were conducted for 20 hospital staff members and 6 stroke-patients as part of the qualitative design, and a questionnaire was administered on all the staff as part of the quantitative design, to analyze the facilitators and barriers to change in stroke-patients. They merged the data from the two designs and identified specific facilitators (e.g. stakeholder support, strong team climate, positive work environments) and barriers (e.g. uni-disciplinary assessment, varied evidence base, negative organizational change) for stroke management. In the current study, I employ a mixed methods design by embedding a multiple-probe single-case experimental design within an overarching interpretive case study to better address my research questions.

The Current Study

Grounded in the distributed communication theory (Hengst, 2015) and the social philosophies of interventions for aphasia (Simmons-Mackie, 2001), this study uses a mixed methods design, combining an interpretive case-study with an embedded multiple-probe single-case experimental design, to study the patterns of communicative changes in four participants with aphasia. The interpretive case-study design uses ethnographic methods (video recording sessions, participant interviews and patient-report measures), and discourse analysis procedures

to understand the different dimensions of the process and effects of intervention. The multiple-probe design involves multiple measures of dependent variables at strategic points of time during the baseline, treatment, and maintenance conditions across individuals.

The data collection included 2 initial assessment sessions, 5 baseline sessions (naming and conversation probe, and 2 patient-report interviews), 15 treatment sessions (involving 15 barrier treatment protocol sessions, 5 probes of naming and conversation, and 3 patient-reported outcomes interviews), and 5 maintenance sessions (naming and conversation probe, and 2 patient-reported outcomes interviews). The data from the interpretive case-study design is representative of the changes in the communicative patterns during the treatment sessions (collaborative referencing), and during outside of the study sessions (PRO measures); the data from the embedded multiple-probe SCD represent changes in the communicative behaviors during probe conditions (naming and conversational probes). The integration of these two datasets allows us to view the changes in communication from multiple perspectives (e.g., how communication changes during treatment, how the patients report their perception of changes in communication, and how communication changes within a clinical- and a conversational setting), thus enhancing the understanding of the overall changes in the communicative patterns.

Therefore, this study is guided by the following three research questions:

(1) Do the participant pairs successfully complete the barrier task trials and show the expected patterns of learning predicted by the collaborative referencing model (Clark & Wilkes-Gibbs, 1986) and by Hengst et al., (2010)?

(2) Is there a functional[1] relation between the BTP and the aphasic participants' improved naming behaviors and collaborative conversational behaviors?

(3) Do the participants with aphasia report any changes in his/her communication abilities outside treatment sessions on conversation profile and communication confidence profile?

The methods and data collection procedures are discussed in detail in the next chapter.

[1] The SCD literature uses the term *functional relation* to refer to the cause effect relation between the independent and dependent variables established by introducing controls within a design. From a distributed communication perspective, we consider functional relation as chains of connections which require a more complex interpretation.

Chapter 4

Methods

This mixed methods study employed an overarching qualitative interpretive case study design with an embedded multiple-probe single-case experimental design that supported the examination of collaborative learning by qualitative discourse analysis methods as well as by controlled experimental methods. Participants included four adults with chronic aphasia and clinician-partners. Videotaped data were collected across multiple tasks during initial assessment sessions, baseline sessions (naming and conversation probes, and patient-reports), treatment sessions (barrier treatment protocol, naming and conversation probes, and patient-reports), and maintenance sessions (naming and conversation probes, and patient-reports). Other data sources included medical records of the participants with aphasia, researcher's online record of treatment performance, patient-reported outcome measures, and researcher logs. Data analysis included interpretive discourse analysis of collaborative referencing during treatment, interpretive analysis of patient-reported outcome measures, and multiple-probe analysis of naming and conversation probes. This chapter details the study participants, data collection, and data analysis procedures.

Participants

Potential participants with aphasia were recruited by distributing flyers at the University clinic, local hospitals and nursing homes. I also attended the local support group and spoke to the participants and speech language pathologists (SLP) and obtained contacts of individuals who showed interest in the study. Out of 6 interested individuals, 4 individuals who met the criteria of the study were recruited as the primary participants. See Appendix A for an example of the flyer and release forms used in the study.

All four primary participants were more than 18 years old, medically stable and in the chronic phase of recovery from brain injury or stroke (i.e., 6+ months post-injury), with a diagnosis of aphasia from a certified SLP, but with no history of cognitive impairments, with normal or corrected vision and hearing, right-handed (pre-stroke), and English as the primary language. Table 4.1 gives details of the four primary participants. The secondary participants included two trained clinician-partners and the caregivers of the PWA. Martha Sherrill (CCC-SLP) served as the clinician-partner for three participants with aphasia, and I, Suma Devanga (SLP-certified in India) served as the clinician-partner for one participant with aphasia. The caregivers of three participants with aphasia observed all the sessions, and were present and

videotaped during patient-report interviews. Signed consent forms were obtained from all primary and secondary participants, and we discussed about the use of pseudonyms and asked them to choose a name for the study. Finally, the research team consisted of a moderator of the study sessions (Carissa Ernat, a trained undergraduate student clinician served as the moderator for 1 pair, and I, the researcher, served as the moderator for 3 pairs of participants), raters of the primary dependent variable, and fidelity raters (two trained undergraduate research assistants), and coding and analysis team (15 trained undergraduate research assistants).

Table 4.1

Characteristics of the primary participants with aphasia.

Participants' pseudonyms	**Ms. C**	**Mr. Bear**	**Mr. David**	**Mr. Depot**
Age/Sex	51/F	68/M	57/M	68/M
Lesion type, Location, S/P post-injury	Hemorrhagic (?), left fronto-temporal CVA, S/P 11 months	Ischemic, left fronto-temporal CVA, S/P 2.1 years	Unknown, left frontal CVA, S/P 8 years	Ischemic, left frontal CVA S/P 5 years
Educational and vocational background	Completed Ph.D, was working as an Asst. Prof. at a university prior to CVA	Completed college, was a retired school principal prior to CVA	Completed high school, was working at the U.S Marine Corps prior to CVA	Completed college, was working as a superintendent at a school prior to CVA
Handedness pre-injury	Right	Right	Right	Right
Languages spoken	English Hindi	English	English	English
Aphasia Type & severity (WAB; BDAE rating)	Mild Anomic aphasia (4) AQ=88.8	Mild Anomic aphasia (4) AQ=88.2	Moderate-severe Broca's aphasia (2) AQ=62.5	Severe Broca's aphasia (2) AQ=68.8
Clinician-partner	Suma Devanga	Martha Sherrill	Martha Sherrill	Martha Sherrill
Caregiver	None present*	Wife	Personal Aide	Wife

*Note: Ms. C lives with her husband, but he did not attend the study sessions.

Profiles of the participants. The profiles of each of the four participants, demographic details, educational and vocational background, communication history and goals are described below.

Ms. C. Ms. C is a college graduate with a Ph.D in bioengineering. She lives with her husband and a dog, and has a daughter who visits them on weekends. Her daily routine included preparing for lectures and seminars, driving to work, conducting lab meetings, teaching, lunch with colleagues or sometimes with husband, and cooking in the evening. Her hobbies included Yoga, listening to traditional Indian music, and practicing calligraphy. At the time of her stroke, Ms. C was working as a research assistant professor at a university.

At the time of the study, Ms. C was 51 years old, 11 months post-stroke, and her overall health was stable. She was still receiving outpatient speech-language therapy and acupuncture therapy, had just regained her driving privileges, and was working toward returning to her job. She was very passionate about her research work and expressed her frustration about having to relearn the concepts that she had mastered and published over the last ten to fifteen years. She was most bothered by her word finding difficulties and extended language processing times. She also seemed concerned about her right hemiplegia that seemed to be limited to her right hand, and was willing to try everything to get the right hand movements back including physiotherapy, occupational therapy, and alternative medicine such as acupuncture. She also reported to be attending out-patient speech-language therapy for the last 10 months with minimal improvements.

Ms. C reported that she had a left hemorrhagic CVA involving the frontal and temporal lobes leading to an expressive aphasia, and a right hemiplegia. During her language assessment using the Western Aphasia Battery-Revised (WAB-R; Kertesz, 2006) and Boston Diagnostic Aphasia Examination-3nd edition (BDAE-3;Goodglass, Kaplan, & Barresi, 2001), Ms. C's profile was most consistent with mild Anomic aphasia. Her WAB Aphasia Quotient (AQ) was 88.8 (on 100), Language Quotient (LQ) was 89.5 (on 100), and Cortical Quotient (CQ) was 91.15 (on 100), with maximum difficulties in naming (84 on 100), than in auditory verbal comprehension (180 on 200), spontaneous speech (19 on 20), repetition (8 on 10), reading (97 on 100), or writing (83.5 on 100); and the BDAE's overall aphasia severity was 4 (on 5). Ms. C's communication in everyday activities was assessed using the Communication Activities of Daily Living-2 (CADL-2), and her level of functional communication was high (94th percentile). Ms.

C showed no significant cognitive impairments both on the clock drawing test (no errors), and on the Rey-Osterreith Complex Figure (Osterrieth, 1944) test (31/36; indicating no significant visuo-spatial or memory dysfunctions). Ms. C's conversational speech was fluent with sentence level utterances of 8 to 10 words. Her anomia was evident from long pauses in speech and circumlocutions. She used a variety of syntactic forms and displayed syntactic errors very rarely. Her articulation was normal and she displayed no apraxic behaviors. When asked for communication goals, Ms. C stated that she wanted to be able to understand and talk about her own research easily again; she wanted to get back to teaching, conducting research, and writing.

Throughout the study, I served as her clinician-partner, and Carissa Ernat (trained undergraduate research assistant) served as the moderator. The sessions ran smoothly and were mostly filled with stories of each other from our home country, the different dance forms, the varieties of Indian food, and the difficulties in navigating everyday life in a foreign country. The sessions also became very interesting as we started talking a lot about our own research and its importance in the world.

Mr. Bear. Mr. Bear is a college graduate and a retired school principal. He lives with his wife, but his two children and four grandchildren often visit them. His everyday schedule prior to stroke included driving his grandchildren to school, soccer practice and gym, taking care of the household, grocery shopping with his wife, and giving guest-lectures at schools. His hobbies were watching his grandchildren play soccer or football, spending time with family, going to movies, writing poems, and planning family vacations. At the time of the stroke, Mr. Bear had retired from a junior high school where he taught Biology and served as a principal for 29 years. He had also retired from being an adjunct professor at a university.

At the time of the study, Mr. Bear was 68 years old and more than two years post-stroke. He was medically stable and was no longer receiving outpatient speech-language therapy, except for participating in a stroke support group. Mr. Bear was mainly concerned about his word-finding difficulties and about how people generally talked over him.

Mr. Bear had a left ischemic CVA involving the frontal and temporal lobes which left him with an expressive aphasia. On language assessment using WAB-R and BDAE-3, Mr. Bear was found to have a mild anomic aphasia. His WAB AQ was 88.2 (on 100), LQ was 91.7 (on 100), and CQ was 92.7 (on 100), and the BDAE's overall aphasia severity was 4 (on 5), and he displayed difficulties chiefly in naming (81 on 100), than in spontaneous speech (19 on 20),

repetition (7 on 10), auditory verbal comprehension (200 on 200), reading (96 on 100), or writing (92 on 100). Mr. Bear's communication in everyday activities was assessed using the Communication Activities of Daily Living-2 (CADL-2), and his level of functional communication was high (99th percentile). Also, Mr. Bear showed no significant cognitive impairments both on the clock drawing test (no errors), and on the Rey-Osterreith Complex Figure test (29/36; indicating no significant visuo-spatial or memory dysfunctions). Mr. Bear's conversational speech was fluent with an utterance length of 8 to 10 words. Anomia and syntactic errors were typically seen during testing and throughout the study. His anomia was characterized by semantic and phonemic paraphasias, perseverations, and pauses in speech. He often used the phrase *"isn't it awful?"* whenever he could not think of the right word. Mr. Bear also displayed pronoun errors and some confusion with proper nouns. There were neither articulatory, nor apraxic errors. As a communication goal, Mr. Bear reported that he wanted to be able to easily communicate with his family, especially with his grandchildren. He wanted to work towards creating a more disabled- friendly environment (e.g. wheelchair access to football and soccer games) by writing letters to the authorities. He also wanted to be able to get back to giving guest lectures at schools and helping children at special education schools with reading and math.

Martha Sherrill (CCC-SLP) served as Mr. Bear's clinician-partner for the entire study, while I served as the moderator. All the sessions were very enjoyable as Mr. Bear shared numerous stories about his family vacations, life as a principal, and life with his grandchildren that were humorous. Martha also shared her funny stories from having travelled to different states in the US.

Mr. David. Mr. David is a high school graduate and worked as a janitor at a school and also served in the Marine Corps. He lives with his girlfriend and her son, and is also in contact with his own son and daughter from a previous marriage. He also has two personal assistants who tend to his activities of daily living. Mr. David and his current personal aide have reported that Mr. David has had a troubled childhood and adolescence that included child abuse, attempted suicide, alcoholism and drug abuse. Prior to stroke, Mr. David worked as a janitor at a university for 25 years before joining as a Marine for four years (but did not see combat). As a Marine, he served in different locations across the world including North America, Australia and Asia; his daily work routine included extensive physical training for many hours and also

working as a communication specialist. His hobbies included dining at restaurants, reading comics and novels, listening to music, and dancing. At the time of stroke, Mr. David was still serving in the Marines.

At the time of the study, Mr. David was 57 years old, medically stable, and eight years post-stroke. He was not receiving any speech-language therapy, but was participating in a stroke support group. Mr. David was dependent on his caregivers for most of his everyday activities such as, taking medications, driving, fixing meals, and henceforth. In terms of communication, Mr. David was concerned about his difficulties in general expression, word finding, writing and attention to specific tasks. He was frustrated about being dependent on his caregivers even to order food at restaurants, or to answer phone calls. He had an AAC device that he used rarely to initiate topics of conversation by showing pictures of his family. He also had a diary that had all the information of his contacts, which he used more often than the AAC device, during conversations about family.

Mr. David had a left CVA (of unknown type), involving the frontal lobe, leading to expressive aphasia. There were no medical records from his time in the Marines or from his childhood. During his language assessment using WAB-R and BDAE-3, Mr. David's profile was most consistent with moderate-severe Broca's aphasia. His WAB AQ was 62.5 (on 100), LQ was 61.7 (on 100), and CQ was 66.1 (on 100), with difficulties in spontaneous speech (13 on 20), naming (66 on 100), auditory verbal comprehension (157 on 200), repetition (38 on 10), reading (80 on 100), and writing (33 on 100); and the BDAE's overall aphasia severity was 2 (on 5). Mr. David's communication in everyday activities was assessed using the Communication Activities of Daily Living-2 (CADL-2), and his level of functional communication was moderate (77th percentile). Mr. David showed some mild cognitive impairments on the clock drawing test (4 on 5), and on the Rey-Osterreith Complex Figure test (26/36; indicating possible visuo-spatial dysfunctions, but no significant memory dysfunctions) which could be associated with alcoholism or other childhood histories, but dementia was ruled out. Mr. David's conversational speech was non-fluent with an utterance length of two to three words. His language expression was marked by stereotypic utterances, anomia, limited syntactic forms, and also socially inappropriate utterances on some occasions. He also had difficulty understanding complex sentence structures and sustaining attention for an extended period. Although there were some distorted productions of speech sounds, there were no articulatory or apraxic errors. Mr. David's

goal for his communication was to be more fluent in his expressive speech, to be able to successfully communicate with people in his everyday life, and to become more communicatively independent.

Mr. David was partnered with Martha Sherrill throughout the study, and I served as the moderator. Their sessions were very unique as the themes shifted easily from travel, music, and politics, to food, superheroes, and swimming. Martha struggled to keep conversations going as Mr. David tended to shift topics very easily. However, Mr. David often reported how much he enjoyed these sessions.

Mr. Depot. Mr. Depot is a college graduate and worked as a superintendent at a school district, and also as a school teacher. He lives with his wife, but his two children and four grandchildren visit them regularly. His everyday routine included driving to work, attending meetings, teaching, and working on his construction projects in the evenings, and going to church on weekends. His hobbies were collecting antiques, architectural designing of houses and buildings, construction work, and watching baseball. At the time of the stroke, Mr. Depot was working as a superintendent and also working on a construction project of his current house, and he remembered being under a lot of stress.

At the time of the study, Mr. Depot was 68 years old, medically stable and five years post-stroke. He was receiving outpatient speech-language therapy at a local hospital (once a week) and participating in a stroke support group. His concern about his communication was with respect to the inability to have his own voice and the constant need for his wife to interpret his attempts at speaking to other people. He was also very frustrated about his word finding difficulties and complained about how he gets stuck on words at times and yet gets the right words out easily at some other times. He also used his phone as an AAC device to find the right words, and to help him start new topics of conversation.

Mr. Depot had a left ischemic CVA involving the frontal lobe that lead to an expressive aphasia. On assessment of his language using WAB-R and BDAE-3, Mr. Depot presented with a severe Broca's aphasia, with a WAB AQ of 68.8 (on 100), LQ of 73.7 (on 100), and CQ of 78.2 (on 100), and an aphasia severity of 2 (on 5). His impairments were more notable on expressive language tasks including spontaneous speech (13 on 20), naming (77 on 100), repetition (42 on 100) and writing (67 on 100), and less notable on auditory verbal comprehension (190 on 200) and reading (82 on 100). Mr. Depot's communication in everyday activities was assessed using

the Communication Activities of Daily Living-2 (CADL-2), and his level of functional communication was high (98th percentile). He did not show any significant cognitive impairments on the clock drawing test (4 on 5), or on the Rey-Osterreith Complex Figure test (29/36; indicating no significant visuo-spatial or memory dysfunctions). His conversational speech was characterized by telegraphic utterances that typically included content words, with an average utterance length of around 2 to 3 words. Mr. Depot compensated for his expressive difficulties by using multimodal resources such as gestures, facial expressions, writing/drawing etc. Most of his utterances started with a *"see the…"*, and included significant pauses while he thought of the word. His use of syntactic forms was highly limited and his sentence structures were very simple. However, Mr. Depot had a sophisticated vocabulary and liked to play with words. He did not have any articulatory or apraxic errors. His communication goals were to be able to express his thoughts freely without depending on caregivers, to be able to have regular conversations with children and to be able to offer insights on topics related to world events.

Martha Sherrill was the clinician-partner for Mr. Depot, and I served as the moderator for the study sessions. All the sessions with Mr. Depot were very interesting as he liked to talk about antiques and construction work that Martha and I were novices at. Despite his limited verbal expression of language, he communicated very well with both of us taking advantage of all the resources he had.

Data Collection and Data Analysis Procedures

The Institutional Review Board of the University of Illinois at Urbana-Champaign approved this dissertation research. See Appendix B for the signed approval forms. A total of 108 study sessions with 27 sessions per participant were completed across six to seven months, at the University of Illinois' Speech Language Pathology Clinic, Champaign. Broadly, these sessions included 2 initial assessment sessions, 5 baseline sessions (involving naming and conversation probes, and 2 patient-report interviews), 15 treatment sessions (involving 15 barrier treatment protocol sessions, 5 probes of naming and conversation, and 3 patient-report interviews), and 5 maintenance sessions (involving naming and conversation probes, and 2 patient-report interviews). Therefore, 27 videotaped sessions (per participant), score sheets, medical records, patient-reports, and researcher logs were used for analysis. Table 4.2 summarizes the overall design. Details about the data collection and analysis procedures are described below.

Table 4.2
Summary of the data collection protocol

Study Week	Session Type	Task	Communication Profile (adapted CAPPA)	Communication Confidence Profile (CCRSA)
1	Prep 1	Interview	-	-
1	Prep 2	Assessment	-	-
2	BS 1	CCN & CP	1st	1st
2	BS 2	CCN & CP	-	-
3	BS 3	CCN & CP	-	-
3	BS 4	CCN & CP	2nd	2nd
4	BS 5	CCN & CP	-	-
5	Tx 1	BTP	-	-
5	Tx2	BTP	-	-
5	Tx 3	BTP, CCN & CP	1st	1st
6	Tx 4	BTP	-	-
6	Tx 5	BTP	-	-
6	Tx 6	BTP, CCN & CP	-	-
7	Tx 7	BTP	-	-
7	Tx 8	BTP	-	-
7	Tx 9	BTP, CCN & CP	2nd	2nd
8	Tx 10	BTP	-	-
8	Tx 11	BTP	-	-
8	Tx 12	BTP, CCN & CP	-	-
9	Tx 13	BTP	-	-
9	Tx 14	BTP	-	-
9	Tx 15	BTP, CCN & CP	3rd	3rd
10	MS 1	CCN & CP	-	-
10	MS 2	CCN & CP	1st	1st
11	MS 3	CCN & CP	-	-
11	MS 4	CCN & CP	-	-
12	MS 5	CCN & CP	2nd	2nd

(Note- BS: Baseline; Tx: Treatment; MS: Maintenance; CCN: Collaborative Confrontation Naming; CP: Conversation Probe).

Interpretive case-study design. The current study was designed to replicate the barrier treatment protocol (Hengst, Duff, & Dettmer, 2010), and also to extend it by examining the communicative changes outside treatment using patient-reported outcome (PRO) measures. Each participant completed 2 initial assessment sessions and 15 treatment sessions and was also

administered PRO measures two times each before, during, and after treatment. The interpretive case study design was guided by the following research questions-

1. Do the participant pairs successfully complete the barrier task trials and show the expected patterns of learning predicted by the collaborative referencing model (Clark & Wilkes-Gibbs, 1986)? Specifically, does the pair:
    a) Work together so that the matcher correctly places target cards on his/her playing board to match the arrangement on the director's board (as measured by card placement accuracy)?
    b) Get faster at identifying and placing target cards on subsequent trials [as measured by a reduction in communicative resources (e.g., words, turns, gestures, time, and basic and modified basic exchanges)]
    c) Develop specific labels for each target card, and simplify labels across trials (as measured by analyzing the Initiating Referencing Expressions (IREs) for each target card in each trial)?
    d) Does the participant-pairs' use of conversational repetition of card labels throughout trials demonstrate progression toward successful use of Agreed-upon Target Label (ATL)?
2. Do the participants with aphasia report any changes in his/her communication abilities outside treatment sessions, as measured by Conversation Profile (adapted from Conversational Analysis Profile for People with Aphasia, CAPPA, Whitworth, Perkins, & Lesser, 1997) and Communication Confidence Profile (Communication Confidence Rating Scale for Aphasia, CCRSA, Babbitt & Cherney, 2010)?

Data Collection Protocol for Interpretive Case Study. Data collection for the interpretive case-study included video recordings of all sessions (e.g., pre-treatment assessment, baseline, treatment, and maintenance sessions); notes from medical records for the participants with aphasia; researcher's log, and patient-reported outcomes. I conducted assessments of language and cognitive functioning of the primary participants during the initial assessment sessions; and interviews for the patient-reported outcomes including the conversation profile (modified CAPPA) and communication confidence profile (CCRSA) during the baseline, treatment, and maintenance sessions; and finally, I conducted 15 barrier treatment sessions per participant.

Table 4.3 summarizes the interpretive case-study research questions, dependent variables and data sources.

Table 4.3
Summary of the research questions, measures, and data sources for the interpretive case study.

Research Question	**Measures**	**Data Sources**
Do the participant pairs successfully complete the barrier task trials and show the expected patterns of collaborative learning predicted by the collaborative referencing model?	-Card placement accuracy -Communicative resources - Simplification of labels - Frequency of the use of agreed-upon target labels (ATLs)	Field-notes and video tapes of the barrier treatment sessions
Do the target participants with aphasia report any changes in the communication abilities outside treatment conditions?	Patient-reported outcome (PRO) measures: -Conversation profile -Communication confidence profile	Scores from the adapted CAPPA and CCRSA from the baseline, treatment, and maintenance sessions

Preparatory sessions. The two preparatory sessions included a case history interview, and a complete evaluation of the PWA's language and cognitive status by the administration of Boston Diagnostic Aphasia Examination-3 (BDAE-3; Goodglass, Kaplan & Baressi, 2000), Western Aphasia Battery (WAB; Shewan & Kertesz, 1980), Communicative Activities of Daily Living (CADL-2; Holland, 1999) clock drawing test (Agrell & Dehun, 1998) and the Rey-Osterrieth Complex Figure test (ROCF; Osterrieth, 1944).

Communication confidence profile. Communication Confidence Rating Scale for people with Aphasia (CCRSA) (Babbitt & Cherney, 2010), a PRO measure consisting of 10 questions to be rated on an 11-point rating scale was used to assess the communication confidence. The PWA and his caregiver participated in answering questions on the CCRSA. The communication confidence was assessed twice during baseline and maintenance phases, and 3 times during the treatment phase. For example, the participant was asked to rate his confidence in "*making his own decisions or to follow news on TV*" on the 11-point rating scale. See Appendix D.

Conversation profile. Adapted Conversational Analysis Profile for People with Aphasia (CAPPA; Whitworth, Perkins & Lesser, 1997) was used to assess the *conversation profile* as a PRO measure. The moderator asked yes/no questions from the adapted CAPPA to the PWA and his caregiver twice during baseline and maintenance phases, and 3 times during the treatment phase. The participants were asked to maintain a contact diary to note all their everyday interactions, including talking with friends, family and strangers, telephone conversations,

communication with the media and henceforth. The contact diary was discussed and referred to whenever necessary during the adapted CAPPA administrations. See Appendix E and F.

Barrier treatment sessions. A maximum of 15 barrier treatment sessions were completed with each of the four participant pairs. Note that the barrier treatment also serves as the independent variable for the single-case experimental design. The materials for the treatment and the protocol are explained below:

Figure 4.1. Set-up for the Barrier Treatment Protocol (BTP; Hengst et al., 2010).

(a) *Setting and materials for the barrier treatment sessions:* The materials for the barrier treatment sessions included two numbered wooden playing boards and a wooden barrier. Each playing board was two feet long, one foot wide with twelve numbered spaces for twelve photographs to be placed. A barrier of twelve inches tall, and four feet long, was used to allow players to see each others' faces but prevent them from seeing each others' boards. During the treatment sessions, the two boards were placed opposite to each other, on a rectangular table with the barrier separating the two. The participants sat across the table facing each other and their respective playing boards. See Figure 4.1. All the sessions were conducted at a therapy room in the University Speech Language Pathology Clinic, and were video recorded. The photo-cards for the study were personally relevant and revolved around the subjects of people, places, objects and locations/streets which were significant in the life of the participants (e.g. anniversary, family holiday). 30 photo-cards were selected for every target participant, in such a way that every photo-card had four different views or perspectives, making a total of 120 photo-cards (e.g. View A: anniversary cake cutting with

wife; View B: anniversary cake eating; View C: anniversary cake-smash; View D: anniversary cake making). Views A and B served as the *probe cards* and are discussed in the single-case experimental design section (p. 68). Views C and D served as the *treatment cards* and were used for the BTP in the treatment phase. See Figure 4.2.

Figure 4.2. An example of four views of a photo-card representing Burger King.

12 treatment cards were played in every BTP session. All 30 referencing targets were played twice by the 5th BTP session (i.e., View C: 1-30 treatment cards), then the View D treatment cards for each target (i.e. View D: 1-30) were played twice from the 6th to 10th BTP session. For BTP sessions 11 to 15, View C (1-30) and View D (1-30) were played again for the third time. Table 4.10 summarizes the use of treatment cards in the 15 treatment sessions (p. 69).

(b) Barrier treatment protocol: The BTP was conducted between the clinician-partner (Martha/Suma) and the target PWA, 2-3 alternate days a week, and for 60-90 minutes each at the SLP clinic. Each session began with six trials of the barrier task, during which the participants were assigned the role of a *director* and a *matcher* alternatively for every trial. The moderator distributed a set of 12 personally relevant treatment cards to the director and the replica of the same 12 treatment cards to the matcher. The director was asked to arrange the treatment cards on his board in any manner, while the matcher stacked the replica of the cards at the end of his board. The director and matcher worked collaboratively towards arranging the cards in the same manner as the director, by describing the cards but without looking at each others' boards. Here is a sample of the moderator's instructions to the participant-pair.

"There is only one rule in this game and that is that you can't move or look around the barrier. Other than that, anything goes! Be creative! You can use the cards in any way that you want to. You can use gestures, facial expressions, and you can both talk as much as you want to. The only thing you can't do is move the barrier and look at the order of the cards on the director's playing board."

The moderator left the room during the trial and returned when the director announced the completion of the task. The moderator checked the accuracy of the placements of cards on the matcher's board, and reported the number of correct and incorrect placements to the pair. Six barrier task trials were completed in each session; the target PWA directed the first, third, and fifth trials and the clinician-partner directed the second, fourth and sixth trials. The 12 treatment cards changed every session, so that at the end of 15 sessions each of the 30 references was used six times (three times with View C, and three times with View D). See Appendix G for details of the barrier treatment protocol.

(c) *Agreed-upon target label interview*: At the end of every treatment session, the moderator used a stimulated-response interview format to have the pair describe the label they had settled on for each of the 12 treatment cards used that session. Specifically, the moderator removed the barrier and presented each treatment card one at a time, asking them to *"tell me what you decided to call this card during today's session".* The moderator assured the pair that there was no right or wrong answer, and urged them to describe the label(s) they had come to agreement on for each card during that session.

Data analysis procedures for the interpretive case-study design. Data analysis for the interpretive case-study included on-site analysis (stage I), transcription (stage II), coding and patient-reported outcome analysis (stage III). The on-site analysis included the assessment of card placement accuracy. The moderator monitored the accuracy of card placements after every trial of the barrier task. The transcription stage included transcribing the video recordings of treatment sessions. In the final stage of analysis we identified card placement sequences and coded for the collaborative referencing measures, and analyzed the scores from the patient-reported outcome measures. Table 4.4 summarizes the data analysis procedure.

Stage I: On-site analysis.

Card placement accuracy. In all the barrier treatment sessions consisting of six trials each, the participant pair was required to identify and accurately place 12 treatment cards in each trial. The accuracy of card placements for each session was averaged across six trials for every participant pair, and the percentage of accuracy per session was determined. The overall accuracy of card placement was determined by averaging the scores across 15 sessions for each pair. The results were compared with the existing literature (Clark & Wilkes-Gibbs, 1986;

Hengst et al., 2010). The results were also used for fidelity assessment in the single-case experimental design.

Table 4.4
Overview of the Interpretive-Case Study Data Analysis Procedure.

Stages	**Analysis**	**Description**
Stage I: On-site analysis	Card placement accuracy	Accuracy of card placement in every trial of every BTP session
Stage II: Video Transcription	Pass 1: Verbals Pass 2: Gestures Pass 3: Consensus	Video recordings of 4 treatment sessions (1st, 5th, 11th, and 15th session) were transcribed
Stage III: Coding And Patient report analysis	Card Placement Sequence (CPS)	Coding CPS in every treatment session transcript
	Collaborative referencing measures	Communicative resources: Counts of words, gestures, turns, time and basic/modified basic exchanges
	IRE analysis	Coding the eight types of IREs
	Conversation repetition analysis	- Coding for ATLs and Repetition of ATLs (RATL) - Coding for Non-ATLs (NATLs) and Repetition of Non-ATLs (R-NATLs)
	Conversation profile (Modified CAPPA)	Interpretive analysis of patient-report scores
	Communication confidence (CCRSA)	Interpretive analysis of patient-report scores

Stage II: Transcribing sessions. Successful completion of the barrier task was measured by accuracy of card placements and by how closely the patterns of interactional discourse across trials and sessions matched predictions based on the collaborative referencing model (Clark & Wilkes-Gibbs, 1986) and empirical findings from research on aphasia (Hengst, 2003), amnesia (Duff et al, 2006), and from treatment studies (Hengst et al. 2010). Specifically, the collaborative referencing model predicts that collaborative effort (as measured by the communicative resources used by the pair) declines across trials, and that the pair will develop specific labels for each, which will shorten and stabilize across trials (as measured by analyzing the initiating referential expressions used to identify the target at every trial). To analyze these discourse patterns the video recordings of treatment sessions were first transcribed and then coded for the

communicative resources (e.g. words, turns) during trials and for initiating referential expressions used to identify target cards in every trial. These are described below.

The transcription system that we followed for discourse analysis was adapted from Hengst (2001, 2003). Trained undergraduate and graduate student clinicians of the discourse analysis lab transcribed 4 treatment sessions (sessions 1, 5, 11, and 15) per participant-pair. Considering the time constraints to finish this study, these four sessions were chosen because they represented learning of references across the study. The transcript consisted of all the speakers' initials, and the speech and gestures used by the participants across time. The verbal and gestural data were transcribed in two separate passes. The start and end time for each BTP trial was also marked on the transcript. Every transcript went through a final pass of consensus with another graduate or undergraduate student, and the six barrier task trials of each treatment were marked in the transcript by the use of following codes.

Stage III: Coding and Patient-reported outcome analysis.

Card Placement Sequences (CPS). A CPS is defined as a point in the transcript from which the task of identification and placing of the target card begins, up to the point in which the card is placed in its location. CPS was coded in every treatment transcript aiding in the coding for communicative resources.

Communicative resources. Communicative resources included the *time* taken to complete each trial, and the number of *words, gestures, turns and basic/modified basic exchanges* used in every trial. The following procedures developed by Hengst (2001, 2003) were used.

a. Time. Time was measured in minutes and seconds using the time displayed on the VLC file; start/stop time for each trial was noted on the transcription, and total time was determined by subtracting the start time from the end time. The times calculated for each trial was then entered in an excel sheet.

b. Words, gestures and turns. Words were defined as the amount of verbal space or effort that was used. Gestures were defined as any verbal substitutes significant for conversational interactions including postures, movements, sound effects and actions that call attention to the ongoing activity. Turns were defined as the stretch of verbal or non-verbal expression, starting with one speaker and alternating when the next speaker begins to speak. Words, gestures and turns were counted for each speaker, and for each card placement sequence of every session. The

counts were noted per CPS on the transcript, and were added together and entered in excel sheets. Table 4.5 describes the words, gestures and turns.

Table 4.5
Words, Gestures, and Turns as communicative resources.

Communicative Resources	Descriptions
Words	• Neologisms: Combination of sounds that doesn't make a real word (e.g.sklart = 1) • Single sound repetition (p-part) = 1 • Contractions (can't) = 1 • False starts (s-s-s, no, it was) "s-s-s' is the false start = 4
Counted as 1 word	
Counted separately	• All real words, and filler words (uh, uhm, m hm) • Part-word repetitions (pota-potatoes) = 2 (1 word each) • Neologistic word repetitions (col-cali-cowli-cower) = 4 • Letters: Letters read individually (It's a P-A-R-T) = 6
Gestures	
Counted separately	• Meaningful Gestures (head nod) • Meaningful body movements (leaning forward) • Audible gestures (laughing, singing, highly marked intonation patterns, animal sounds)
Turns	
Counted separately	• Head nods • Simultaneous turns (one speaker says "m hm" when the other speaker is still talking) is counted as a turn for that speaker. E.g. D: I love the barrier task but it can be tough to code Turns: 1 L: m hm Turns: 1

c. Basic and modified basic exchanges. Clark and Wilkes-Gibbs (1986) developed the basic exchange category which was defined as the placement of the target card without any revision or refashioning of the initiating referential expression used for the target card. This was commonly a two-turn sequence. Hengst (2001) developed a modified basic exchange category which was coded when there were multiple turns taken to initiate a reference, or when non-task topics were discussed in the card placement sequence, or when there was no overt collaboration for the card placement (commonly on the last card placement). Each CPS was analyzed to identify basic (BE) or a modified basic exchange (MBE) and they were marked in the transcript and then added and entered in the excel sheet. Trained undergraduate research assistants coded for BE and MBE on all 4 transcripts per participant pair. A consensus coding pass was conducted on all the codes of communicative resources on all four transcripts per participant.

Initiating Referential Expressions (IRE). The initiating referencing expressions were coded for every card placement sequence across trials and sessions. Clark (1992) describes that these noun phrases represent the developing common ground between the participant-pairs, with a shift from indefinite descriptive expressions in the initial trials to more streamlined definite expressions in the later trials. The use of different IREs is also argued to be indicative of

different levels of confidence of the director that a certain reference is easily understood by the matcher. These displays of confidence in the use of IREs were compared with the patient-reports of communication confidence (CCRSA) throughout the study sessions. All the IREs were classified into one of the eight types described below, which were taken directly from Hengst, (2001, 2003) and Hengst et al. (2010). Table 4.6 illustrates the eight IRE types (with increasing levels of confidence), operational definitions and their examples. The IRE analysis was conducted on the first and last session of using all the 30 references with both views. A consensus coding pass was conducted on all the IRE codes for all four participants.

Conversational repetition of agreed upon target labels (ATLs). At the end of every barrier treatment session, the participant pair was asked for the agreed-upon label for the treatment cards. During this task, the target PWA or partner reported the label that they most frequently used for every card that was played in that session. These labels were analyzed to determine the frequency of use of these ATLs in conversational repetitions across the treatment sessions. Hengst et al., (2010) argued that a high frequency of use of ATLs in conversational repetition during the barrier task indicated a repeated engagement in a meaningful activity which fosters learning. Every ATL repeated within a trial during conversations was coded as an R-ATL. If the participants referred to a treatment card by any label that was not an ATL, it was coded an N-ATL. Every N-ATL repeated within a trial during conversations was coded as an R-NATL. Table 4.7 displays the ATL types, operational definitions, and examples.

Table 4.6

Classification of the Initiating Referencing Expressions (IREs), definitions and examples.

IREs	Operational definition	Example
Description (Des)	Indefinite descriptions marked by an indefinite article (a/an), resemblance (looks like), categorization (it's a ___), attribution (it has a ___), and action (it is standing)	*"It looks like a whole bunch of these um..things"*
Elementary (Elm)	Definite reference including both the noun and modifiers, produced by one speaker in a single intonational group	*"it's the dining room"*
Episodic (Eps)	Definite reference including both the noun and modifiers, produced by one speaker in one or more intonational groups	*"There are cars on the street, lined up, facing the Champaign-Mahomet sign."*
Provisional (Prv)	Definite reference noun phrase produced by one speaker with multiple intonational groups including revisions, replacements, or self-repairs of paraphasias, without prompts from the listener.	*"it's the one with the girls…they're all sitting…um no they're watching a game."*
Installment (Inst)	Multiple definite reference noun phrases produced by the speaker and the listener offers acceptances to allow the reference to evolve	***P:*** *It's J-J-Jeff* ***C:*** *M-hm* ***P:*** *and um his son* ***C:*** *Yes* ***P:*** *Trent* ***C:*** *Alright.*
Placeholder (P1H)	Definite reference initiated with a placeholder expression (filler word/gesture/pauses/neologism) completed by speaker/listener	***P:*** *two people..they gi- uh thi- tish- tish- wa- teesh-wersh…..uh……..uh…* ***C:*** *Two people at Halloween?*
Proxy (Prx)	Definite noun phrase created by both participants, usually begun by one and completed by another	***P:*** *It's J-Jeff and and..* ***C: Trent***
Other	Definite noun phrase created by using gestures or offered by the partner with no overt collaboration	***P:*** *The last one* ***C****: is McD*

Table 4.7
Classification of Agreed-upon Target Labels (ATLs), definitions, and examples.

ATL types	Operational definition	Examples
Agreed upon target label (ATL)	If the first label produced by the participant/s for each card included key elements and/or at least half of the original expression, then the label was coded as ATL. ATLs included identical labels, close approximations, partial productions, and expansions.	*M: "Bush on number one"* [ATL] *MD: "Ok, I got Bush"* [RATL]
Repetition of ATL (RATL)	If the repetition of the label included key elements and/or at least half of the original expression, then the label was coded as R-ATL (including identical labels, close approximations, partial productions, and expansions).	*M: "We can call this something else other than just Bush"* [RATL]
Non-ATL (NATL)	If the first label produced by the participant/s for each card does not include key elements and/or at least half of the original expression, then the label was coded as N-ATL.	M: "*One is our ex-President*" [NATL] MD: *"Ok, the ex-president"* [RNATL]
Repetition of NATL (R-NATL)	If the repetition of the label does not include key elements and/or at least half of the original expression, then the label was categorized as R-NATL (including identical labels, close approximations, partial productions, and expansions).	

Analysis of the conversation profile. The adapted CAPPA was administered on the participants (with help from the contact diaries) twice during the baseline, and maintenance sessions, and 3 times during the treatment sessions. To analyze the profile, we looked at each of the domains individually across the study weeks. All of the "yes" responses were coded as "+", and "no" responses were coded as "-". The "+" and "-" responses were analyzed further to examine the constructive changes across the sessions, by comparing the individual responses to the pre-stroke profile (which was obtained during the Baseline 1 session). Any change in "+" or "-" that was similar to the pre-stroke profile was considered a constructive change. These changes were monitored across sessions and were plotted on a graph. To increase the reliability

of this patient-reported outcome measure, contact diary was maximally utilized and every response from the target PWA was confirmed with the caregiver.

Analysis of communication confidence. The CCRSA was administered on the target participants twice during the baseline, and maintenance sessions, and 3 times during the treatment sessions. The scores from the CCRSA were analyzed by determining the mean and individual scores of each domain. The mean scores from each domain for all the participants were compared across the study weeks and plotted on a graph.

Single-Case Experimental Design (SCD). To systematically investigate the effects of the BTP treatment on participants' communication abilities in clinical tasks outside treatment, specifically on naming and conversation, we embedded a multiple-probe SCD within the interpretive case-study design. The multiple-probe across-individuals design evaluates the relation between increased communicative behaviors in PWA and the BTP treatment. The BTP served as the independent variable for the SCD. We selected dependent variables on two different communicative behaviors: naming and conversation. Every participant pair completed a maximum of 15 BTP treatment sessions, 5 baseline sessions, 5 treatment probes, and 5 maintenance sessions. This design allowed us to establish internal controls to meet the conditions for using SCD. The multiple-probe design was guided by the following research questions:

1. Is there a functional relation between the BTP and the aphasic participants' improved naming behaviors as measured by labeling a set of personally relevant photographs on a collaborative confrontation naming (CCN) task?
2. Is there a functional relation between the BTP and the aphasic participants' improved collaborative conversational behaviors with a clinician partner as measured by content and non-content Synchrony measures?

***Data collection protocol for Single-Case Experimental Design*.** To answer the above research questions, we embedded multiple controls and probes throughout the study. Data collection for SCD included video-recordings of all study sessions (baseline, treatment, and maintenance sessions), researcher's log, and online scores of probes. The baseline, treatment probe and maintenance sessions included a collaborative confrontation naming task (CCN) using probe-cards, and a ten minute conversation task. Baseline, treatment probe, and maintenance sessions were designed to match the controls implemented during treatment sessions in all ways except for application of the treatment (i.e., independent variable). The treatment consisted of 15

barrier treatment sessions. Table 4.8 summarizes the research questions, dependent variables and data sources of the multiple-probe single-case experimental design.

Table 4.8
Summary of the research questions, dependent variables and data sources for multiple-probe SCD.

Research Question	Dependent Variable	Data Sources
Is there a functional relation between the BTP and the aphasic participants' improved naming behaviors?	Collaborative Confrontation Naming (CCN) label scores	Video tapes and field notes on collaborative confrontation naming task in the baseline, treatment and maintenance phases
Is there a functional relation between the BTP and the aphasic participants' improved collaborative conversational behaviors with a clinician partner?	Conversational synchrony: -Non-content Synchrony: Words + gestures; per turn -Content Synchrony: Interactional Discourse Resources (IDR)	Video tapes of the 10 minute conversation between the pair in the baseline, treatment and maintenance phases

Baseline phase. After the completion of initial assessment sessions, the baseline phase was initiated first with Ms. C, followed by a staggered onset of baseline phase with Mr. Bear, Mr. David, and finally Mr. Depot. The baseline phase consisted of 5 sessions of 20 to 30 minutes each spread across three weeks with 1 to 2 sessions per week. Each session began with the participant pair seated in a therapy room at the SLP Clinic. The session began with an exchange of greetings, and then the moderator explained the two tasks for the day: naming and conversation. For naming task, the moderator explained to the target PWA—*"I will give 12 pictures to you, one after the other, and I would like you to give me a name for each card. You can say the name out loud, or write it or use your device. Martha/Suma can jump in, but only if you need any help".* The moderator produced 12 personally relevant probe cards and asked the participant to come up with a name for each card. The clinician-partner (Martha/Suma) was instructed to give opportunity for the target participant to label the card first, and to suggest a label only if he fails to do so, or if asked for help. The CCN labels produced were noted down by the moderator for scoring on the PICA scale (Porch Index of Communicative Ability; Porch, 1971). The CCN task was then followed by a conversation task. The moderator asked the clinician-partner to move to the same side as the target PWA for the conversation task. The following instructions were given— "*Now, we have a ten-minute conversation task. You both need to have a general conversation on any topic that you would like. Just imagine that you are*

talking to your friend at a restaurant. I will come back after ten minutes." The clinician partners were familiarized with the mediated discourse elicitation protocol, but no other training (e.g. what topics to talk about, or how much to talk) was given. At the end of ten minutes, the moderator walked into the room, and casually joined in and ended the conversation task.

Treatment phase. When the scores on the primary dependent variable (CCN) remained stable during the baseline phase, the treatment phase was initiated by the introduction of the independent variable (i.e., barrier treatment protocol; Hengst et al., 2010). The details of the treatment protocol are explained in the interpretive case-study design section (p. 56). After every third treatment session, naming (CCN) and conversation probes were conducted, with a total of 5 probes in the treatment phase. The CCN score after the introduction of the treatment for the first participant (Ms. C) was assessed to determine if there was an increase from the baseline level. An increase of more than 10 in the total CCN score (per session) was considered as a threshold to initiate the treatment for the following participants. The treatment was introduced to the second (Mr. Bear), third (Mr. David) and fourth (Mr. Depot) participants based on the magnitude of increase in performance level from baseline. The individual CCN probe during baseline served as the experimental control to assess the treatment effect. The treatment was continued until the scores on the probes stabilized, but for a maximum of 15 sessions.

Maintenance phase. The maintenance phase began at least two days after the end of the treatment, consisting of a minimum of five sessions (20-30 minutes each) of collaborative confrontation naming (CCN) and conversation probes (similar to the baseline phase).

Dependent variables.

Collaborative Confrontation Naming (CCN) Probe. CCN served as the primary dependent variable and was defined as the production of the words, phrases and/or sentences by the PWA on presentation of personally relevant photo-cards, followed by an agreement and a collaborative feedback from the partner. The moderator presented 12 photo-cards to the target PWA and the partner during the baseline, treatment (every third session), and maintenance probes. Examples of CCN labels include *'Burger King', 'Beach vacation', 'this was our favorite..the one where we took a trip to the woods'* etc. Non-examples of CCN labels include no response, or indication of inability to respond. Every CCN label produced by the PWA was scored by two trained raters using the adapted 15-multidimensional scoring system of the PICA scale. See Table 4.9.

Table 4.9

Adapted Multi-dimensional scoring of Collaborative Confrontation Naming (CCN) task [Source: (Porch, 1971)]

Score	Level	Description
15	Complete	Accurate, responsive, complete, immediate response to test item
14	Distorted	Accurate, responsive, complete, response to test item, but with reduced facility of production
13	Complete-delayed	Accurate, responsive, complete response to the test item which is significantly slowed or delayed
12	Incomplete	Accurate, responsive, response to test item which is lacking in completeness
11	Incomplete-delayed	Accurate, responsive, incomplete response to test item which is significantly slowed or delayed
10	Corrected	Accurate response to test item self-correcting a previous error without request or after a prolonged delay
9	Repetition	Accurate response to test item after a repetition of the instructions by request or after a prolonged delay
8	Cued	Accurate response to test item stimulated by a cue, additional information, or another test item
7	Related	Inaccurate response to test item which is clearly related to or suggestive of an accurate response
6	Error	Inaccurate response to the test item
5	Intelligible	Intelligible response which is not associated with the test item, for example, perseverative or automatic responses or an expressed indication of inability to respond
4	Unintelligible	Unintelligible or incomprehensible response which can be differentiated from other responses
3	Minimal	Unintelligible response which cannot be differentiated from any other response
2	Attention	Patient attends to test item but gives no responses
1	No Response	Patient exhibits no awareness of test item

Inter-observer agreement was calculated for each agreement and disagreement in the two ratings by using the point-by-point agreement formula:

$$\frac{\text{Score Agreements x 100}}{\text{Score Agreements + Score Disagreements}}$$

Score agreement was defined as the two raters obtaining the same score on the 15-point scoring system for every card/session observed. Score disagreement was defined as the two raters obtaining a different score on the 15-point scoring system for every card/session observed.

The mean IOA was calculated for each participant pairs. The total score of CCN labels obtained in every probe session was documented for further analysis.

Conversation Probe. A 10-minute conversation task between the participant and the clinician was conducted in every baseline, treatment probe, and maintenance sessions using the mediated discourse elicitation protocol (Hengst & Duff, 2007). See Appendix C. This protocol allowed for an everyday conversation between the participant pairs instead of scripted events. We used content and non-content synchrony measures as the secondary dependent variables: *(i) Non-content Semiotic Synchrony:* Average number of words and gestures in the first quarter and the last quarter of the 10-minutes conversation were used to calculate the synchrony score for every session in the baseline, probe and maintenance phases (Gupta, 2012); *(ii) Content Synchrony:* Interactional Discourse Resources (IDRs) were used to determine the content synchrony. The four IDRs: repetition/reformulations, narratives, playful episodes, and procedural discourse were counted in each of the conversation probes between the participant pair. The frequency of words and gestures produced within the IDRs early in the conversation was compared to that in the later part of the conversation to calculate the content synchrony score.

Setting and Materials. 30 personally relevant photo-cards were selected for every target participant, in such a way that every photo-card had four different views or perspectives, making a total of 120 photo-cards. Views A and B served as the *probe cards* and were used for the CCN probe in the baseline, probe and maintenance sessions. Views C and D served as the *treatment cards* and were used for the BTP in the treatment phase. The 30 referencing targets were assessed twice in the CCN task (with View A and View B) during baseline, treatment probe and maintenance sessions. Table 4.10 summarizes the use of probe cards and treatment cards in the study sessions.

The other materials for the barrier treatment included two wooden playing boards, a wooden barrier, and a table and chairs for participants. During the CCN task, the participant with aphasia and the clinician-partner sat opposite each other with a table in between. During the conversation task, the clinician-partner moved to the same side of the table as the target PWA to get into a more natural conversation-like setting. During the treatment, the participant pair sat opposite each other, with two boards placed in front of each other, on a rectangular table with the barrier separating the two. All the sessions were conducted at a therapy room in the University of Illinois Speech Language Pathology Clinic.

Table 4.10
Summary of the use of probe cards and treatment cards in the study.

Study Session	Probe cards (CCN)	Treatment cards (BTP)
BS 1	View A (1-12)	-
BS 2	View A (13-24)	
BS 3	View A (25-30) + View B (1-6)	
BS 4	View B (7-18)	
BS 5	View B (18-30)	
Tx 1	-	View C (1-12)
Tx 2	-	View C (13-24)
Tx 3 (Probe 1)	View A (25-30) + View B (1-6)	View C (25-30) + (1-6)
Tx 4	-	View C (7-18)
Tx 5	-	View C (18-30)
Tx 6 (Probe 2)	View A (1-12)	View D (1-12)
Tx 7	-	View D (13-24)
Tx 8	-	View D (25-30) + (1-6)
Tx 9 (Probe 3)	View B (7-18)	View D (7-18)
Tx 10	-	View D (18-30)
Tx 11	-	View C (1-12)
Tx 12 (Probe 4)	View A (13-24)	View C (13-24)
Tx 13	-	View C (25-30) + View D (1-6)
Tx 14	-	View D (7-18)
Tx 15 (Probe 5)	View B (18-30)	View D (18-30)
MS 1	View A (1-12)	-
MS 2	View A (13-24)	
MS 3	View A (25-30) + View B (1-6)	
MS 4	View B (7-18)	
MS 5	View B (18-30)	

Independent variable. The barrier treatment protocol served as the independent variable for the multiple-probe single-case experimental design. The treatment protocol has been described earlier (p. 56).

Fidelity of Implementation of the Dependent and Independent Variables. In order to ensure the baseline, treatment probe, and maintenance sessions were implemented in accordance with the research protocol, fidelity was calculated for all the probe sessions. Two research assistants watched all videotaped baseline, treatment probe, and maintenance sessions to record the presence or absence of required components. The required components included using 12 probe cards for the CCN task, partner offering the label only when asked for by the PWA, opportunity for multimodal responses, moving the participants to a comfortable conversational

setting, and allowing participants' choice of topic for the conversation probe (See Appendix H). Fidelity score was calculated by dividing the total number of included required components by the total number of required components. A mean fidelity score of 100% was maintained across all baseline, treatment probe, and maintenance sessions in all four participants. The inter-observer agreement for the fidelity scores was calculated and also found to be 100%. These scores indicated that the baseline, treatment probe, and maintenance sessions were implemented consistently across the four participants and according to the research protocol. Individual fidelity scores for each required component for the baseline, treatment probe, and maintenance sessions are provided in Tables 4.11.

Table 4.11
Fidelity scores for Baseline, Treatment probe, and Maintenance Sessions across participants.

Participants	**12 probe cards**	**Offering label only on request**	**Multimodal responses**	**Conversational setting**	**Choice of conversational topic**
BASELINE					
Ms. C	100%	100%	100%	100%	100%
Mr. Bear	100%	100%	100%	100%	100%
Mr. David	100%	100%	100%	100%	100%
Mr. Depot	100%	100%	100%	100%	100%
TREATMENT PROBE:					
Ms. C	100%	100%	100%	100%	100%
Mr. Bear	100%	100%	100%	100%	100%
Mr. David	100%	100%	100%	100%	100%
Mr. Depot	100%	100%	100%	100%	100%
MAINTENANCE:					
Ms. C	100%	100%	100%	100%	100%
Mr. Bear	100%	100%	100%	100%	100%
Mr. David	100%	100%	100%	100%	100%
Mr. Depot	100%	100%	100%	100%	100%

To ensure the adherence to the treatment protocol, an assessment of the independent variable was conducted. The independent variable was defined as the application of the BTP treatment with successful collaborative referencing between the PWA and his partner. The treatment fidelity was computed by rating the adherence to the barrier treatment protocol on a 3-point scale by two trained undergraduate research assistants. They observed three random treatment sessions and rated the fidelity. See Appendix I. The scores were then converted to a percentage (score/10 x 100). The mean treatment fidelity score was calculated to be 100%, and

was maintained across all participants. Individual fidelity scores for the three random sessions across four participants are summarized in Table 4.12. The Inter-Observer Agreement (IOA) for fidelity rating was calculated using the point-by-point agreement formula, and was found to be 100%. Accuracy of card placement was also used as a fidelity measure, as successful collaborative referencing leads to accurate card placements. The accuracy of card placements was measured for every BTP session, and scored out of 12. A percentage accuracy of card placement was also measured. This will be discussed in the Results chapter (p. 75).

Table 4.12

Treatment fidelity score for three random treatment sessions across four participants

Participants	**BTP Session X**	**BTP Session Y**	**BTP Session Z**
Ms. C	100%	100%	100%
Mr. Bear	100%	100%	100%
Mr. David	100%	100%	100%
Mr. Depot	100%	100%	100%

Note: X, Y, and Z indicate three random treatment sessions

Social validity. The social validity of the intervention was assessed by interviewing the target PWA, their family and the clinician partners, about the social significance of goals, practicality of the procedure and importance of the effects measured. See Appendix J for all the interview questions. The target PWA, their caregivers (if any), the clinician-partner, and the researcher sat together for the interview, which was held at the University of Illinois Speech-Language Pathology Clinic, where all the other study sessions were conducted.

Data Analysis Procedures for Single-Case Experimental Design. Data analysis for SCD includes on-site analysis (stage I), transcription (stage II), and coding and analysis (stage III). On-site analysis included the card placement accuracy and the collaborative confrontation naming (CCN) analysis. The moderator scored the CCN labels that the target PWA produced in every baseline, treatment probe, and maintenance sessions. The transcription stage included transcribing the video recordings of the conversation tasks. In the final stage of coding and analysis, the conversation probes, the data from the social validity interviews, and the CCN-IOA were analyzed. Table 4.13 summarizes the overview of data analysis procedure.

Table 4.13
Overview of the Data Analysis Procedure.

Stages	Analysis	Description
Stage I: On-site analysis	CCN analysis	CCN labels produced by target PWA for every card in every session were scored on the PICA scoring system
Stage II: Video Transcription	Pass 1: Verbals Pass 2: Gestures Pass 3: Consensus	Video recordings from all the conversation tasks of baseline, treatment probe, and maintenance sessions were transcribed
Stage III: Coding and analysis	CCN scoring	The inter-observer agreement on PICA multi-dimensional scores will be determined.
	Conversation Probe (CP) analysis	Coding non-content semiotic Synchrony: • Count the #words and # gestures in the first quarter and last quarter of the CP • Calculate the Synchrony score Coding content Synchrony: • Identify and code the four IDR types in the CP • Count the #words and # gestures in the IDRs in the first quarter and last quarter of the CP • Calculate the Synchrony score
	Social validity	Combining data from the researcher's log and from the videotaped interviews

Stage I: On-site analysis.

Collaborative confrontation naming. The participant pairs completed the CCN task in baseline, treatment probe and maintenance sessions. The results from this task were analyzed to determine the treatment effects in the multiple-probe design. The scores of CCN labels produced by the target PWA were noted in every baseline session, and the treatment was initiated for the consequent participant pairs only when the CCN scores showed a stable increase of >10 for the preceding participant-pair. These values were then plotted on a graph to display the treatment effects. The inter-observer agreement (IOA) for CCN scores was calculated. The treatment effect size was also calculated.

Stage II: Transcribing sessions.

To analyze the conversational synchrony among the four participant-pairs, the conversation probes during baseline, treatment probe, and maintenance sessions were transcribed using Hengst's (2001, 2003) transcription system. Trained undergraduate and graduate research assistants transcribed all the conversation probe sessions in the discourse analysis lab. The verbal

and gestural data were transcribed in two separate passes. A final pass of consensus was conducted with another graduate or undergraduate student.

Stage III: Coding and analysis

Analyzing Conversational Synchrony. The ten-minute conversation samples were transcribed, and coded for content and non-content synchrony.

a. Non-content Conversational Synchrony. The conversational analysis for non-content semiotic synchrony included counting the number of words, turns and gestures. The same definitions for words, turns and gestures as described in p.60 were used. To calculate the synchrony score, each conversation sample was divided into segments of approximately 60 seconds, respecting the turn boundaries. The frequency of words, gestures and turns produced by the pair early in the conversation was compared to that in the later part of the conversation. To determine whether the pair becomes more similar by the end of conversation, the percentage difference in the number of words and gestures (per turn) produced by each participant was calculated for each segment and averaged over the first quarter of the conversation duration (up to 2-3 segments), and compared to the percentage difference of these variables in the last quarter of the conversation (Gupta, 2012). Non-content semiotic synchrony is considered to be displayed if the semiotic behaviors (number of words and gestures, per turn) produced by the participants became more similar at the end of the conversation compared to the beginning.

$$\text{Conversational synchrony score} = \frac{\text{Absolute \% difference between the productions of the PWA and partner during the last quarter of the session} - \text{Absolute \% difference between the productions of the PWA and partner during the first quarter of the session}}{\text{Absolute \% difference between the productions of the PWA and partner during the first quarter of the session}}$$

The interpretation of conversational synchrony scores is described below (Gupta, 2012):

>0: Target participant with aphasia is producing a greater percentage of words at the end of the interaction relative to the beginning

0: No conversational synchrony due to no change in the dyad's production across the interaction

-1 to 0: Conversational synchrony (due to reduced differences in productions across the interaction relative to the beginning)

<-1: Clinician partner is producing a greater percentage of words at the end of the interaction relative to the beginning

b. Content Synchrony. The analysis of content synchrony included four types of interactional discourse resources (Hengst et al., 2016). The ten minute conversation samples were coded for the following IDRs— *(i) Playful episodes (PE):* PEs are defined as different forms of verbal play and humor, including playing with sounds and meanings of words (e.g., rhyming, punning, telling jokes), teasing, and playing with voices (e.g., acting out characters); may include exchanges with laughter; *(ii) Narratives (N):* Narratives refer to episodes reporting actual or fictitious events displaced from the time of the telling, may include narratives of personal experience, retellings of others' stories, and hypothetical narratives; *(iii) Procedural discourse (PD):* PDs refer to episodes of establishing expert-novice relationship where the expert provides information, instructions, or plans, for doing something, which is often presented as a series of steps (e.g., setting a trip itinerary); and *(iv) Repetitions/Reformulations:* These include relatively immediate and visible repetitions of one's own or another's productions of sounds, words and phrases; including the original saying and the repetition(s) that follow, with no more than three interactional turns between each saying. The total number of IDRs produced by each participant in each conversation probe was noted. The number of words and gestures in the IDRs in the first quarter and last quarter of the conversation was identified, and the content synchrony score was calculated and interpreted using the same formula as before.

Social validity analysis. At the end of the study, the target PWA and their family, and the clinician partner were interviewed for their views on the social validity of the treatment. The six-question interview format is summarized in Appendix J. The data obtained was analyzed by observing the videotaped interview sessions and by comparing those with the researchers' logs.

Summary

This dissertation is designed as a mixed methods research with an overarching interpretive case study design (that aims to study the changes in the communicative patterns during the treatment sessions by analyzing collaborative referencing, and outside of the study sessions by analyzing PRO measures) with an embedded multiple-probe single-case experimental design (that aims to investigate the changes in the communicative behaviors during naming and conversation probes) on four participants with chronic aphasia and the clinician-partners. The next chapter presents the combined results from these two designs.

Chapter 5

Results

In the current research, four participants with aphasia, and clinician-partners completed a total of 27 sessions each, that included initial assessment, baseline, treatment and maintenance sessions across 2-3 months. The entire data collection was completed in approximately 24 weeks with very consistent engagement by the participants. All participants completed the full study without missing any sessions, and were highly responsive when sessions needed to be rescheduled around travel conflicts or weather conditions. However, the rescheduling of the sessions did not threaten the controls of the embedded single-case experimental design. This chapter presents the analyses from the mixed methods study and discusses the results around the three research questions: (1) Do the participant pairs successfully complete the barrier task trials and show the expected patterns of learning predicted by the collaborative referencing model (Clark & Wilkes-Gibbs, 1986) and by Hengst et al.,(2010)? (2) Is there a functional relation between the BTP and the aphasic participants' improved naming behaviors and collaborative conversational behaviors? (3) Do the participants with aphasia report any changes in his/her communication abilities outside treatment sessions on the conversation profile and communication confidence profile?

Evidence of Successful Collaborative Referencing during Treatment Trials

The four participants with aphasia displayed successful collaborative referencing with their clinician partners during the treatment trials. Specifically, discourse analysis documented that all four participant pairs displayed communicative patterns predicted by the collaborative referencing model (Clark & Wilkes-Gibbs, 1986; Hengst, 2003)—pairs accurately placed treatment cards, reduced their communicative effort across trials, and developed and simplified initiating referencing expressions across trials. In addition, analysis of referencing expressions for treatment cards used by the pairs during trials demonstrated a strategic use of conversational repetition to hone the card labels. Findings for each of these are presented below.

Accurate card placements across trials. As expected from previous research, all participant pairs completed the barrier task trials with high accuracy. For each trial, the participant pairs placed 12 treatment cards. A total of 1080 treatment cards were placed by each participant pair in 90 trials spread across 15 sessions. Three participant pairs (Ms. C and Suma; Mr. Bear and Martha; and Mr. Depot and Martha) achieved 100% accuracy, and Mr. David and

Martha achieved 99.8% accuracy. The mean accuracy of card placements for the four participants across 15 barrier treatment sessions was found to be 99.95% (range: 99.8% - 100%).

Reduction in collaborative effort across trials. Out of the 15 barrier treatment sessions, four sessions (sessions 1, 5, 11, and 15) per participant pair were analyzed for the use of communicative resources. As expected, the collaborative effort or the use of communicative resources reduced across the barrier task trials in all the four participant pairs. This was demonstrated by the decline in the length of barrier task trials (see Table 5.1), decline in the number of words (see Table 5.2); gestures (see Table 5.3); and turns (see Table 5.4), and an increase in the use of basic/modified-basic exchanges (see Table 5.5).

Table 5.1
Time (presented in min:sec) taken by each pair to complete the first-sixth barrier task trials, presented as the mean and range of the four BTP sessions analyzed. .
(Trials 1, 3, and 5: Directed by PWA; Trials 2, 4, and 6: Directed by Clinician).

	Ms. C		**Mr. Bear**		**Mr. David**		**Mr. Depot**	
Time	**Mean**	**(Range)**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**
Trial 1	16:13	(2:29-31:14)	08:33	(5:12-9:33)	06:31	(3:33-10:47)	11:41	(4:32-21:35)
Trial 2	05:19	(2:45-6:52)	11:37	(5:33-16:31)	04:28	(3:11-5:37)	09:20	(3:35-16:54)
Trial 3	03:51	(2:16-6:47)	10:12	(3:53-18:35)	03:53	(2:08-5:35)	10:11	(3:07-17:34)
Trial 4	05:49	(3:12-8:20)	09:38	(2:40-21:06)	05:51	(5:00-6:04)	08:11	(3:26-15:27)
Trial 5	07:45	(1:43-21:33)	05:38	(2:16-7:35)	04:25	(2:23-6:42)	05:21	(3:44-6:52)
Trial 6	03:30	(2:15-3:57)	04:36	(2:10-6:35)	05:31	(3:08-7:26)	07:33	(3:22-11:54)

Table 5.2
Words used by each pair to complete the first-sixth barrier task trials, presented as the mean and range of the four BTP sessions analyzed.
(Trials 1, 3, and 5: Directed by PWA; Trials 2, 4, and 6: Directed by Clinician).

	Ms. C		**Mr. Bear**		**Mr. David**		**Mr. Depot**	
Words	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**
Trial 1	1518	(237-3442)	985.5	(679-1298)	676.75	(456-1041)	736.75	(255-1422)
Trial 2	379	(218-576)	1514.7	(623-2502)	614.25	(437-781)	656.5	(245-1102)
Trial 3	349.25	(148-711)	1221	(427-2288)	385	(264-494)	652.75	(338-1363)
Trial 4	617.25	(304-965)	1234.5	(333-2725)	790.75	(737-869)	610.25	(248-1008)
Trial 5	759.75	(153-2314)	605.75	(265-955)	555.25	(273-907)	311	(215-385)
Trial 6	219	(119-322)	559.75	(263-882)	709	(494-919)	468.5	(236-623)

Table 5.1 shows the mean and range of time taken to complete trials 1-6 in the four treatment sessions selected (with the PWA directing the trials 1, 3, and 5; and the clinician- partner directing trials 2, 4, and 6). The mean time reduced from trial 1-5 and trial 2-6 in all four participant pairs.

Table 5.3

Gestures used by each pair to complete the first-sixth barrier task trials, presented as mean and range of the four BTP sessions analyzed.
(Trials 1, 3, and 5: Directed by PWA; Trials 2, 4, and 6: Directed by Clinician).

	Ms. C		Mr. Bear		Mr. David		Mr. Depot	
Gestures	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**
Trial 1	183.75	34-418	179.25	126-279	122.5	79-213	110	37-241
Trial 2	36	25-67	292.75	129-502	102	80-132	103	28-161
Trial 3	36.75	13-82	149.25	61-274	81	54-120	94	46-192
Trial 4	76.75	50-110	171.75	60-381	156.5	131-168	120.5	44-223
Trial 5	108.25	21-308	76	24-133	117.25	51-176	37.75	21-47
Trial 6	27	3-57	81.5	46-115	134	85-172	63.75	28-94

Table 5.4

Turns used by each pair to complete the first-sixth barrier task trials, presented as mean and range of the four BTP sessions analyzed.
(Trials 1, 3, and 5: Directed by PWA; Trials 2, 4, and 6: Directed by Clinician).

	Ms. C		Mr. Bear		Mr. David		Mr. Depot	
Turns	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**
Trial 1	237	(44-555)	110	(107-218)	144.25	(97-222)	118	(46-252)
Trial 2	60.75	(45-84)	103	(91-372)	133.5	(101-160)	108	(44-187)
Trial 3	54.5	(31-96)	94	(68-323)	98	(65-133)	104.25	(63-204)
Trial 4	89.25	(55-133)	120.5	(60-405)	174.75	(144-204)	99.25	(54-155)
Trial 5	128.5	(31-331)	37.75	(41-186)	132.5	(82-183)	50.25	(39-69)
Trial 6	47.75	(25-81)	63.75	(41-141)	164.5	(106-211)	75	(46-88)

Table 5.5

Basic/modified basic exchanges used by each pair to complete the first-sixth barrier task trials, presented as mean and range in the four BTP sessions analyzed.
(Trials 1, 3, and 5: Directed by PWA; Trials 2, 4, and 6: Directed by Clinician).

	Ms. C		Mr. Bear		Mr. David		Mr. Depot	
BE/MBE	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**	**Mean**	**Range**
Trial 1	7.5	(0-12)	2.75	(0-6)	8	(7-9)	8.25	(5-11)
Trial 2	9.25	(6-12)	4	(0-12)	10.5	(9-12)	9.25	(3-12)
Trial 3	10.75	(9-12)	4.5	(0-10)	9.25	(7-11)	9	(2-12)
Trial 4	9.75	(5-12)	6	(0-12)	11	(10-12)	9.75	(3-12)
Trial 5	9.75	(7-12)	7.25	(2-12)	9	(8-10)	10.25	(8-12)
Trial 6	11	(9-12)	9.5	(7-12)	10	(9-11)	10.5	(7-12)

Tables 5.2, 5.3, and 5.4 show the mean and range of words, gestures, and turns respectively, used to complete trials 1-6 in the four treatment sessions selected. The mean of words, gestures, and turns reduced from trial 1-5 and trial 2-6 in all four participant pairs. Table 5.5 shows the mean and range of basic/modified basic exchanges used to complete trials 1-6 in

the four treatment sessions selected. The mean of basic/modified basic exchanges increased from trial 1-5 and trial 2-6 in all four participant pairs. The communicative resources used by the four participants across trials indicate a reduction in collaborative effort as predicted by the collaborative referencing model. Although there is a general trend of reduced collaborative effort, the data seem to be variable across trials. This variability is not surprising considering that we encouraged conversations between the clinician and clients, within and across trials in treatment sessions, unlike the barrier task research protocol (Clark & Wilkes-Gibbs, 1986; Hengst, 2003). In addition, analyzing four out of 15 sessions may not have completely captured the changes in collaborative effort between the participant pairs across trials.

Developing and simplifying Initiating Referencing Expressions (IRE). To evaluate the patterns of development and use of referencing expressions for treatment cards across trials, the initiating referencing expressions (IREs) were analyzed and coded into eight categories as described by Clark and Wilkes-Gibbs (1986) and Hengst (2001, 2003). To analyze the patterns of simplification *across sessions* and *across trials,* the IRE analysis was conducted on the first and last use of the treatment cards (i.e., the first 5 and last 5 sessions). Figures 5.1a and 5.1b display the changes in the IREs from first 5 sessions (I) to last 5 sessions (II) throughout the 6 trials. The use of indefinite referential expressions (i.e., descriptive) were more common during the first 5 treatment sessions, whereas the definite referential expressions (i.e., elementary, episodic etc.) were more frequently observed in the last 5 treatment sessions. Therefore, the use of simplified IREs increased as the treatment sessions progressed in all four participant pairs.

On *across trial* analysis, the complex descriptive IREs were the highest in the initial trials, and simplified IREs such as the elementary and episodic were the highest in the non-initial trials as predicted by previous research. Table 5.6 represents the total number of IRE types and percentages in 10 treatment sessions across trials for the four participants. For example, in the 1st trial of the barrier task, Mr. Bear referred to a card as *This is at our- at the beer bear wild park…water park water park* (Provisional IRE), these expressions were simplified to *the uh uh bear uh water park* (Episodic IRE) in Trial 3, and *the bear water park* (Elementary IRE) in Trial 5. Thus, the use of descriptive IREs reduced across trials, and the use of simplified IREs (such as, elementary or episodic) increased across trials in all four participant pairs.

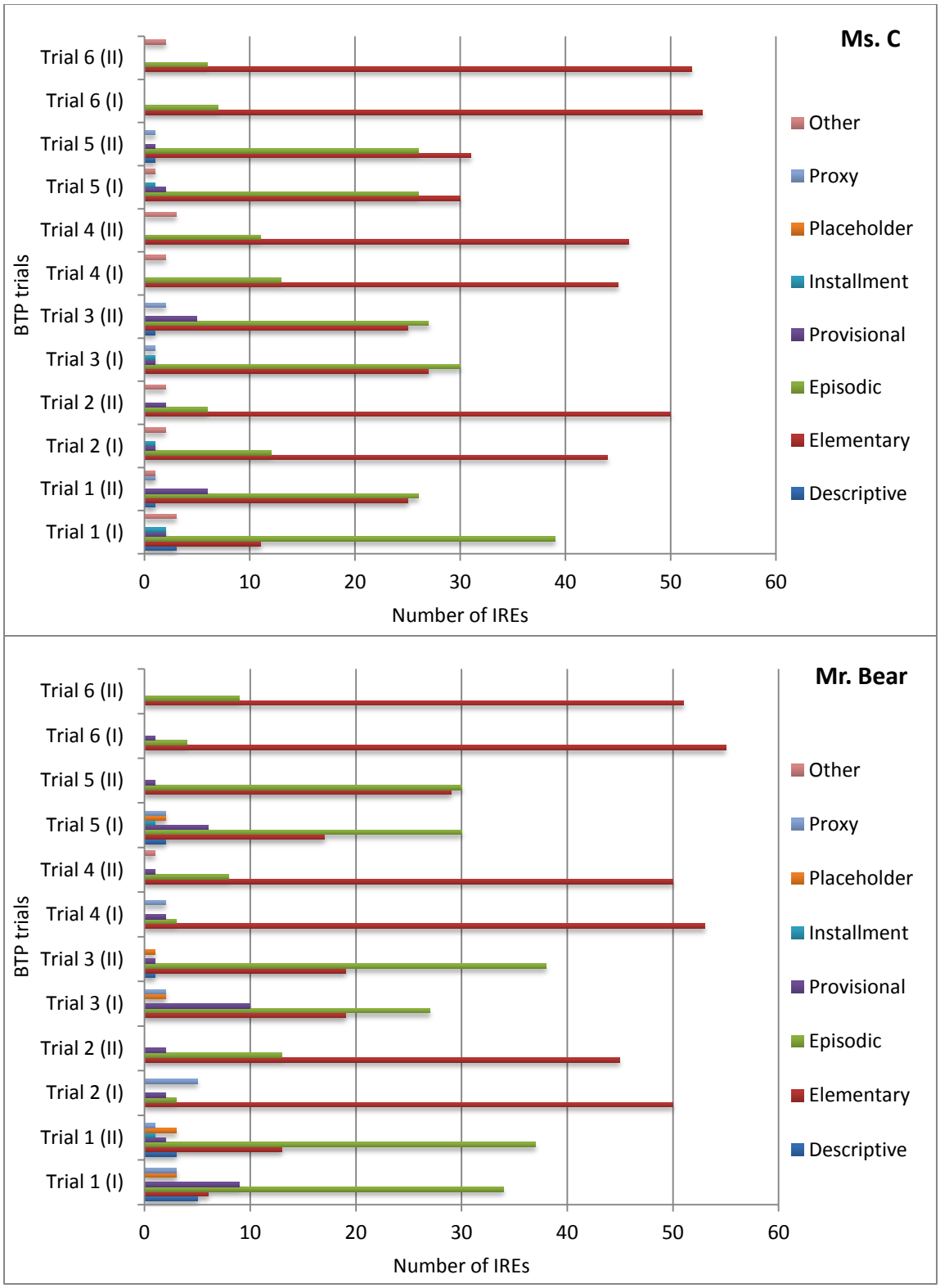


Figure 5.1a. Total IRE types across sessions [in first 5 sessions (I) and last 5 sessions (II)] and across trials in Ms. C and Mr. Bear.

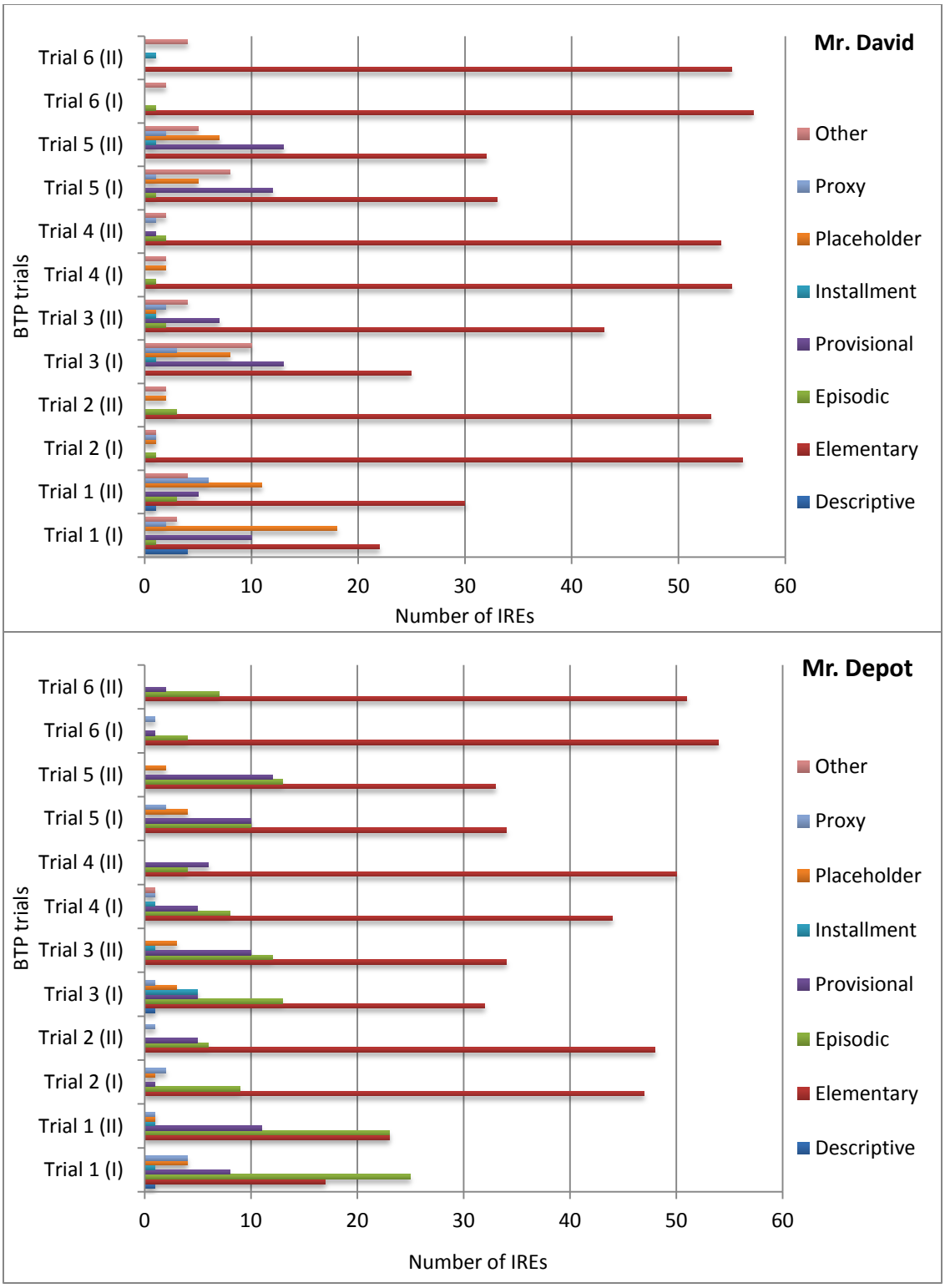


Figure 5.1b. Total IRE types across sessions [in first 5 sessions (I) and last 5 sessions (II)] and across trials in Mr. David and Mr. Depot.

Table 5.6

Total Initiating Referencing Expressions (IREs) used by the four participants in 10 treatment sessions across trials. (Trials 1, 3, 5: Directed by PWA; Trials 2, 4, 6: Directed by Clinician)

IRE TYPES	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6
Ms. C						
Descriptive	4	0	1	0	1	0
Elementary	36	94	52	91	61	105
Episodic	65	18	57	24	52	13
Provisional	8	3	6	0	3	0
Installment	2	1	1	0	1	0
Placeholder	0	0	0	0	0	0
Proxy	1	0	3	0	1	0
Other	4	4	0	5	1	2
TOTAL	**120**	**120**	**120**	**120**	**120**	**120**
Mr. BEAR						
Descriptive	8	0	1	0	2	0
Elementary	19	95	38	103	46	106
Episodic	71	16	65	11	60	13
Provisional	11	4	11	3	7	1
Installment	1	0	0	0	1	0
Placeholder	6	0	3	0	2	0
Proxy	4	5	2	2	2	0
Other	0	0	0	1	0	0
TOTAL	**120**	**120**	**120**	**120**	**120**	**120**
Mr. DAVID						
Descriptive	2	0	0	0	0	0
Elementary	53	108	67	109	65	112
Episodic	4	5	3	5	1	1
Provisional	15	0	20	1	25	0
Installment	0	0	2	0	1	1
Placeholder	30	3	9	0	12	0
Proxy	8	1	5	1	3	0
Other	8	3	14	4	13	6
TOTAL	**120**	**120**	**120**	**120**	**120**	**120**
Mr. DEPOT						
Descriptive	1	0	1	0	0	0
Elementary	40	93	64	94	67	105
Episodic	48	20	26	16	26	11
Provisional	16	3	16	7	19	3
Installment	5	0	6	1	0	0
Placeholder	5	1	6	0	6	0
Proxy	5	3	1	1	2	1
Other	0	0	0	1	0	0
TOTAL	**120**	**120**	**120**	**120**	**120**	**120**

Strategic use of conversational repetition. The referencing expressions used by the four participant-pairs in the barrier task trials were compared with the agreed-upon target labels (ATLs) that they decided at the end-of-session ATL interviews. To examine the conversational repetition of labels, we analyzed the labels used across ten treatment sessions. We coded all the referencing expressions into one of four categories: agreed-upon target label (ATL), non-agreed upon target label (NATL), repetition of agreed upon target label (R-ATL), and repetition of non-agreed upon target label (R-NATL). The first use of an ATL by either the PWA or the clinician-partner within a card placement sequence was coded as ATL with any consequent use of ATL within that card placement sequence coded R-ATL; the first use of any other label except the ATL for the target card was coded as NATL, and any consequent uses coded R-NATL.

Minimally in each card placement sequence, the director offered a label and the matcher repeated it before placing it on the board, leading to 12 initiating referencing expressions per trial and 72 initiating referencing expressions per session, making it a maximum of 720 ATL/NATL for 10 sessions. However on analysis, each of the participant pairs used a high number of referencing expressions and they repeated their own and each other's referencing expressions a large number of times. To examine the conversational repetition of labels across sessions, the analysis was conducted on the first and last use of the treatment cards i.e., the first 5 and last 5 treatment sessions. Figures 5.2a and 5.2b, display the use of ATL types by the participant pairs across treatment sessions. The use of ATLs remains consistent across sessions in all participant pairs. Although there is variability in the number of RATLs across participants and across sessions, the graphs clearly show that conversational repetition is prevalent not only during the first use of treatment cards (i.e., the first 5 sessions), but also during the last use of treatment cards (i.e., the last 5 sessions). In addition, the use of NATLs and RNATLs shows a general decrease from the first use to the last use of treatment cards across participants, which indicates learning of referencing expressions. Tables 5.7a and 5.7b represent the counts of ATL, NATL, RATL, and RNATL used by the four participant-pairs in ten treatment sessions. The consistent use of the ATLs for referencing and their subsequent repetition in conversations indicate successful learning and use of the references throughout the treatment sessions.

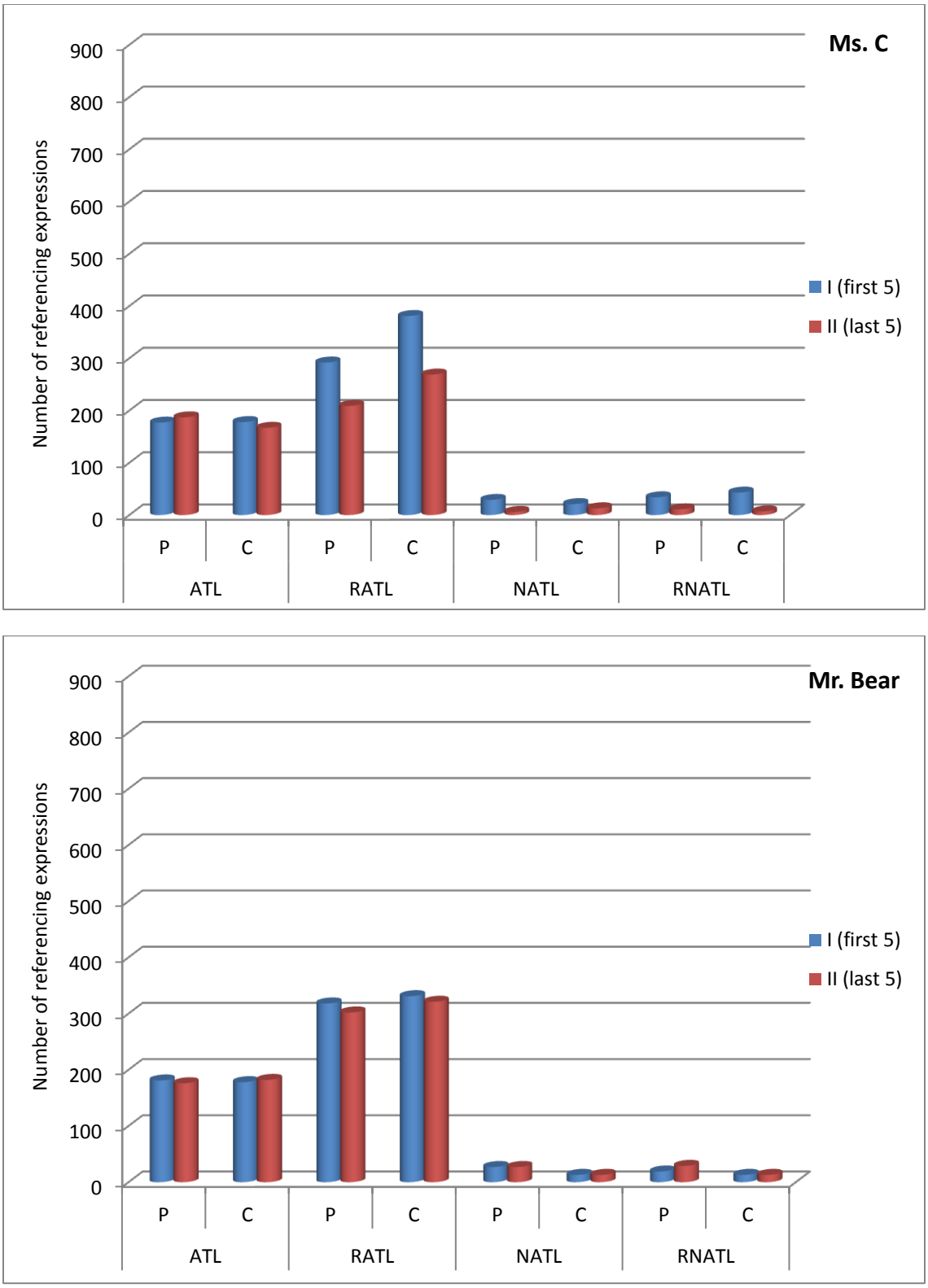
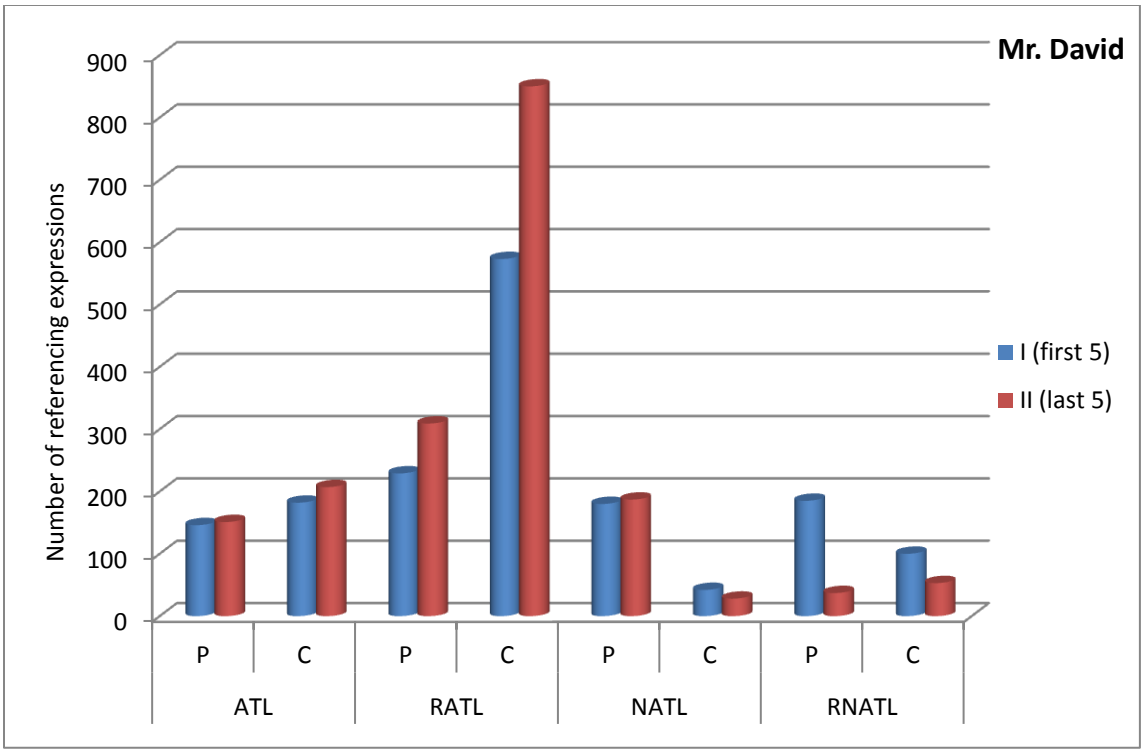


Figure 5.2a. Use of ATL types by the Patient (P) and Clinician (C) during the first 5 treatment sessions (I) and last 5 treatment sessions (II) by Ms. C and Mr. Bear.



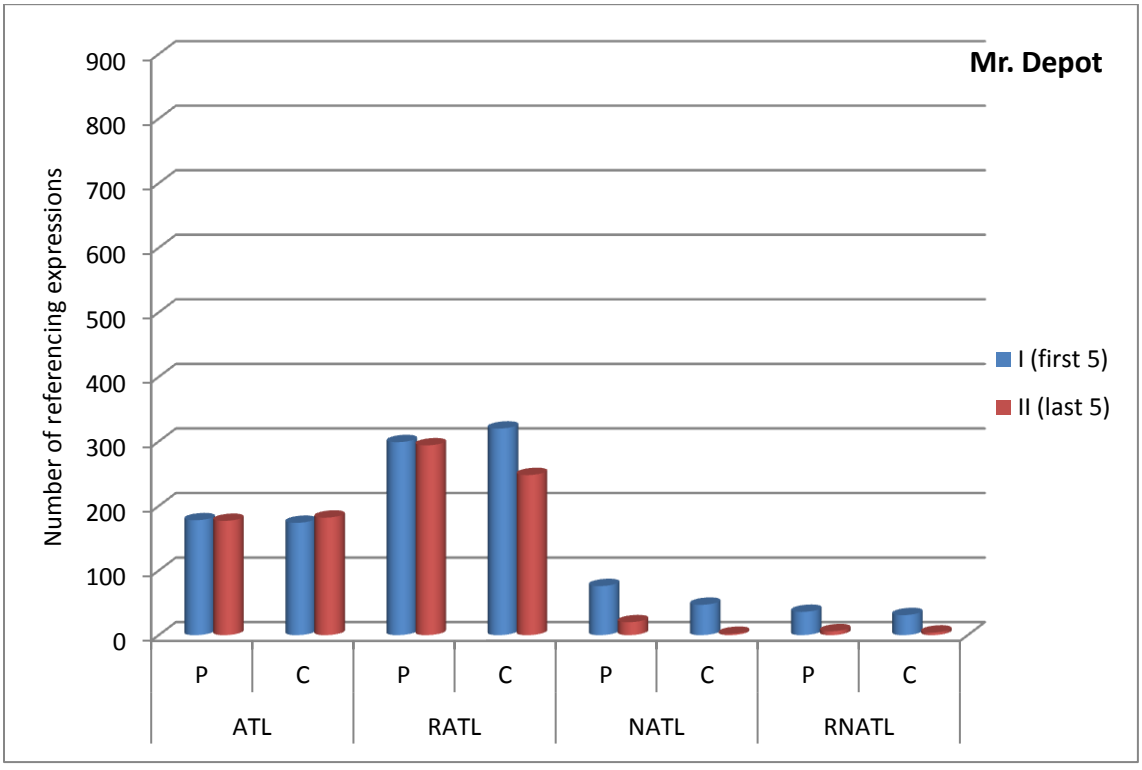


Figure 5.2b. Use of ATL types by the Patient (P) and Clinician (C) during the first 5 treatment sessions (I) and last 5 treatment sessions (II) by Mr. David and Mr. Depot.

Table 5.7a

Number of referencing expressions coded as agreed upon target label (ATL), non-agreed upon target label (NATL) repetition (R-) of the ATL or NATL in ten treatment sessions of Ms. C and Mr. Bear.

		Ms. C								***Mr. Bear***							
		ATL		**RATL**		**NATL**		**RNATL**		**ATL**		**RATL**		**NATL**		**RNATL**	
Card Sets	**Sessions**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**
C1, C2	Tx1	33	39	57	97	6	0	1	2	34	38	36	67	1	0	0	0
C3, C4	Tx2	33	39	56	71	8	2	13	16	39	32	70	60	10	7	1	3
C5	Tx3*	18	18	37	51	1	0	1	0	17	19	52	41	5	1	5	1
D1, D2	Tx6	40	29	67	64	3	6	5	2	36	36	72	72	5	0	5	3
D3, D4	Tx7	37	33	49	72	5	10	8	14	37	35	51	49	6	3	3	3
D5	Tx8*	16	20	26	26	6	3	6	9	18	18	37	42	0	2	5	3
C1, C2	Tx11	37	35	46	53	3	0	3	0	35	37	75	77	9	8	13	11
C3, C4	Tx12	36	36	39	46	1	1	0	0	36	36	68	82	11	1	14	0
C5, D1	Tx13	38	34	51	77	0	1	2	4	37	35	50	50	1	2	0	0
D2, D3	Tx14	36	30	32	48	2	10	5	2	34	36	53	54	3	2	2	2
D4, D5	Tx15	40	32	41	45	0	1	1	1	34	38	56	58	3	0	0	0
Total		**364**	**345**	**501**	**650**	**35**	**34**	**45**	**50**	**357**	**360**	**620**	**652**	**54**	**26**	**48**	**26**
TOTAL (both P & C)		**709**		**1151**		**69**		**95**		**717**		**1272**		**80**		**74**	

*Sessions 3 and 8 are counted as one session since the card sets C5 and D5 were half of the total card sets used in the session, respectively.

Table 5.7b

Number of referencing expressions coded as agreed upon target label (ATL), non-agreed upon target label (NATL) repetition (R-) of the ATL or NATL in ten treatment sessions of Mr. David and Mr. Depot.

		Mr. David								***Mr. Depot***							
		ATL		**RATL**		**NATL**		**RNATL**		**ATL**		**RATL**		**NATL**		**RNATL**	
Card Sets	**Sessions**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**	**P**	**C**
C1, C2	Tx1	29	38	48	163	25	8	7	22	37	32	46	56	44	27	12	17
C3, C4	Tx2	32	39	53	97	30	2	3	15	35	37	56	74	6	4	2	0
C5	Tx3*	13	23	15	95	19	9	1	3	18	18	32	36	4	2	3	1
D1, D2	Tx6	27	39	45	114	43	15	13	46	34	35	63	62	9	10	9	7
D3, D4	Tx7	29	23	38	6	46	7	159	8	37	35	63	62	7	2	5	2
D5	Tx8*	16	20	30	98	17	1	2	6	17	17	39	30	6	2	5	4
C1, C2	Tx11	27	43	50	116	27	6	1	8	36	36	69	61	0	0	0	0
C3, C4	Tx12	31	41	76	228	61	9	16	22	36	36	52	48	2	1	0	0
C5, D1	Tx13	31	41	47	135	26	2	2	2	35	37	65	44	3	0	0	1
D2, D3	Tx14	33	39	49	156	32	6	7	9	36	36	58	53	9	1	0	1
D4, D5	Tx15	29	43	87	215	41	5	11	12	34	37	50	42	6	0	6	2
Total		**297**	**389**	**538**	**1423**	**367**	**70**	**222**	**153**	**355**	**356**	**593**	**568**	**96**	**49**	**42**	**35**
TOTAL (both P & C)		**686**		**1961**		**437**		**375**		**711**		**1161**		**145**		**77**	

*Sessions 3 and 8 are counted as one session since card sets C5 and D5 were half of the total card sets used in the session, respectively.

Evidence from Naming and Conversational Behaviors

The participant pairs completed two probes (i.e., naming and conversation) in each baseline, treatment probe, and maintenance session (with a total of 15 naming probes and 15 conversation probes, per participant, throughout the study). Specifically, the multiple-probe single-case experimental analysis documented evidence of improved naming behaviors from baseline to treatment phase, and maintenance of the learned behavior during the maintenance phase, in all four participants with aphasia. However, analysis of the conversation probe did not show improved synchrony with treatment, and revealed inconsistent synchrony scores across participant pairs. The social validity interviews revealed positive responses from the participants, clinicians, and caregivers. Findings from each of the probes and from the social validity interviews are discussed below.

Collaborative Confrontation Naming (CCN) probe. Each participant with aphasia named 12 probe cards (per session) with collaborative feedback from the clinician-partner during baseline, treatment probe, and maintenance sessions, which were scored by two raters using the adapted PICA (Porch, 1971) scoring system. The inter-observer agreement was found to be 93.75%, which was calculated using point-by-point formula. Figure 5.3 represents the total score per session of each individual with aphasia on the CCN task. The study sessions were initiated around the same time for all four PWAs. Ms. C completed her 5 baseline sessions, and when the baseline scores were stable, she was introduced to the treatment. After every 3rd treatment session, the CCN probe was conducted, with a total of 5 probes during 15 treatment sessions. When the scores improved (i.e., >10) from baseline for Ms. C, the treatment was introduced to Mr. Bear, and then the same procedure was followed for Mr. David and Mr. Depot.

The following four types of analysis were conducted on the multiple-probe data: *(i) Vertical analysis of the data* was conducted to evaluate the design (as seen in Figure 5.3). Positive treatment effects were observed and noted as the baseline changed only when the treatment was introduced. Also, the treatment was introduced for the second, third, and fourth participants only when the CCN score had a magnitude change of >10 for the previous participant. The internal validity of the study was maintained as there were four demonstrations of basic effects at four different points of time. The external validity of the study was maintained as there was replication of the treatment effects across four participants. Further, there were eight phases and four maintenance phases, with five data points in each phase. Therefore, the study

meets the standards set by Horner, Carr, Halle, McGee, Odom & Wolery (2005); *(ii) Within-phase analysis* was conducted to evaluate the evidence from the multiple-probe design. Within the baseline phase, there were no variations in any of the four participants except Ms. C, who showed a baseline trend that appeared to stabilize by the 4^{th} and 5^{th} sessions. The baseline scores of all participants could successfully predict the future scores if no treatment was introduced, thus indicating stability. Within the treatment phase, there was some increase in scores for Mr. Bear and Mr. Depot, and a highly visible increase for Mr. David. Also, no significant variability was evident in the data within the treatment phase. During the maintenance phase, the data were consistent with no significant variations in the performance, and the treatment effects appeared to be maintained in all four participants up to three weeks post-treatment; *(iii) Between-phase analysis* was conducted to evaluate the evidence from the multiple-probe design. The between-phase analyses revealed that there was no significant overlap of data among the four participants. However, Mr. David's treatment probe-2 score comes close to his Baseline-2 score, but it still does not overlap. Also, we see an immediacy of effect, i.e. the scores increase (>10) as soon as the treatment is introduced, and this is consistent across participants. The no-significant variation in baseline phase, the immediate effect in the treatment phase, and the maintenance of scores with no significant variations in the maintenance phase was consistently observed across all four participants. Therefore, the study appears to have strong evidence for positive treatment effects; *(iv) Estimation of effect-size* was conducted to determine the magnitude of positive treatment effects observed during the treatment sessions in all four participants with aphasia. Tau-U, a non-parametric measure was used to estimate the treatment effect size by measuring the data non-overlap between the baseline and treatment phases in all four participants. Since Ms. C showed a baseline trend, we chose to use the Tau-U measure which assessed the simple overlap between phases and also controlled for positive baseline trend in Ms. C. The CCN scores of the four participants in the baseline, treatment probe, and maintenance sessions were fed to the web-based Tau-U calculator. We found a Tau-U treatment effect size of 0.92 at $p<0.0001$. This indicates that there is a positive effect in about 92% of the overall data from baseline to treatment phase (with controlling for baseline trend in Ms. C), which is significant at $p<0.0001$. The results from the Tau-U analysis are illustrated in Table 5.8.

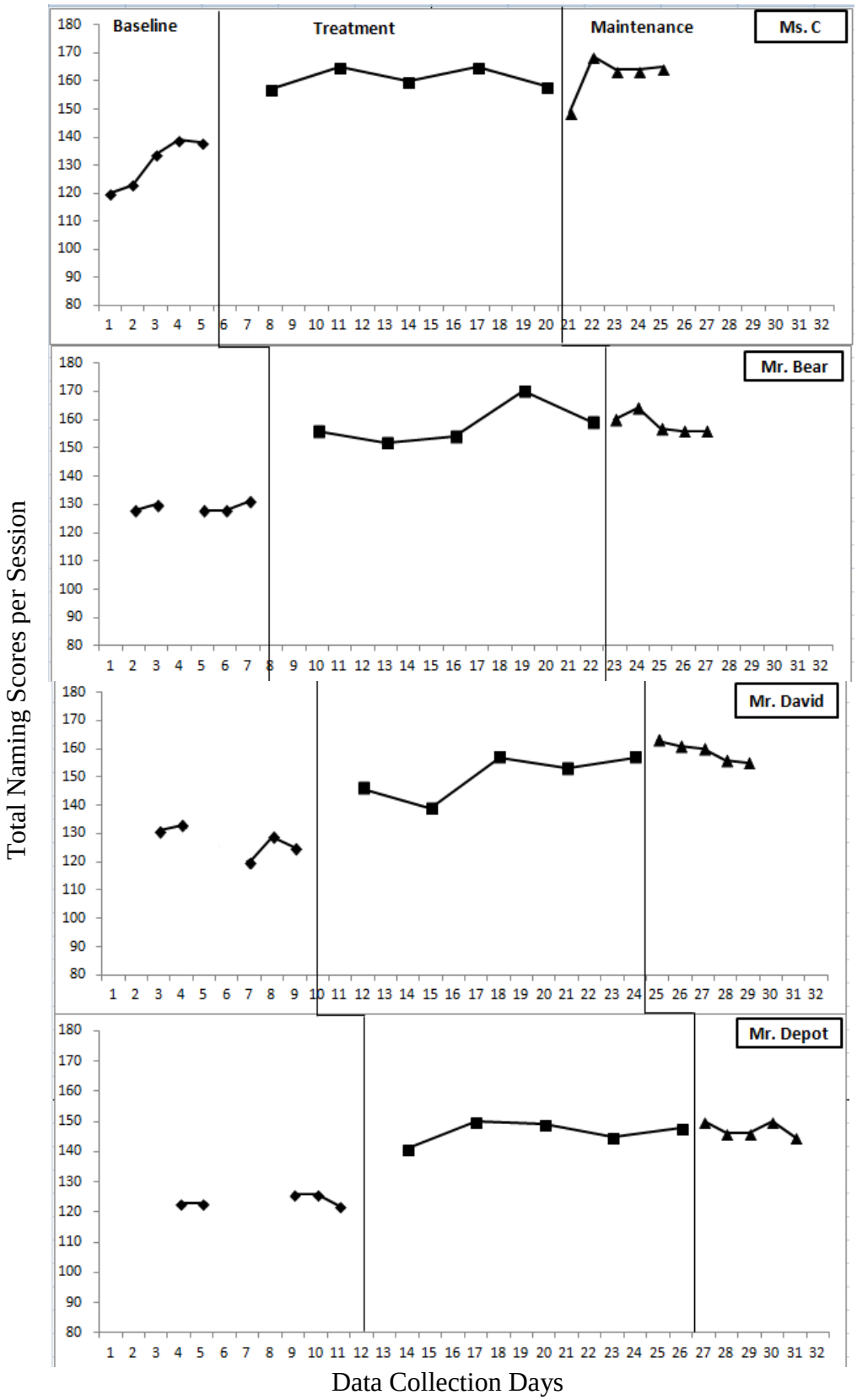


Figure 5.3. *Total adapted PICA scores of CCN for all four participants across study sessions.*

Table 5.8

Results from the Tau-U analysis of the treatment effect size with baseline trend control.

Trend:

id	Label	S	Pairs	TAU	TAUb	VARs	SD	SDtau	Z	P value	CI 85%	CI 90%
0	BS1 vs BS1	8	10	0.8	0.8	16.6667	4.0825	0.4082	1.9596	0.05	0.212<>1.388	0.128<>1.472
1	BS2 vs BS2	3	10	0.3	0.3529	16.6667	4.0825	0.4082	0.7348	0.4624	-0.288<>0.888	-0.372<>0.972
2	BS3 vs BS3	-4	10	-0.4	-0.4	16.6667	4.0825	0.4082	-0.9798	0.3272	-0.988<>0.188	-1.072<>0.272
3	BS4 vs BS4	0	10	0	0	16.6667	4.0825	0.4082	0	1	-0.588<>0.588	-0.672<>0.672
4	BS1 vs BS1	8	10	0.8	0.8	16.6667	4.0825	0.4082	1.9596	0.05	0.212<>1.388	0.128<>1.472

Phase:

id	Label	S	Pairs	TAU	TAUb	VARs	SD	SDtau	Z	P value	CI 85%	CI 90%
6	BS2 vs Tx2	25	25	1	1	91.6667	9.5743	0.383	2.6112	0.009	0.449<>1.551	0.370<>1.630
7	BS3 vs Tx3	25	25	1	1	91.6667	9.5743	0.383	2.6112	0.009	0.449<>1.552	0.370<>1.631
8	BS4 vs Tx4	25	25	1	1	91.6667	9.5743	0.383	2.6112	0.009	0.449<>1.553	0.370<>1.632

Corrected baseline:

id	Label	S	Pairs	TAU	TAUb	VARs	SD	SDtau	Z	P value	CI 85%	CI 90%
5	BS1 vs Tx1	17	25	0.68	0.68	91.6667	9.5743	0.383	1.7756	0.0758	0.129<>1.231	0.050<>1.310

Weighted average:

Label	TAU	Var-Tau	Z	P value	CI 85%	CI 90%	CI 95%
#6+#7+#8+#5	0.92	0.1915	4.8045	<0.0001	0.6443<>1.1957	0.6050<>1.2350	0.5447<>1.2953

Note: The order of participants is 1-Ms. C; 2-Mr. Bear; 3-Mr. David; and 4-Mr. Depot.

Conversation probe. Each participant pair completed a 10-minute conversation task during each baseline, treatment probe, and maintenance sessions, to analyze the changes in non-content and content conversational synchrony. To understand and determine changes in conversational synchrony, I piloted a non-content conversational synchrony analysis by collecting a 10-minute conversation sample from two undergraduate research assistants before the beginning of this study. On analysis of number of words and gestures used by the pair in the first 1/3rd and the last 1/3rd of the 10-minute conversation sample, we found a non-content synchrony score of -0.34, indicating that the pair was synchronous.

Non-content conversational synchrony. The videotaped conversation samples from the four participant pairs were first transcribed, and the number of words and gestures were counted. To calculate the synchrony score, each conversation sample was divided into segments of approximately 60 seconds, respecting turn boundaries. The frequency of words and gestures produced by the pair early in the conversation was compared to that in the later part of the conversation. To determine whether the pair becomes more similar by the end of conversation, a non-content synchrony score was calculated by comparing the percentage difference of the words and gestures in first and last quarters of the session with the percentage difference in the first quarter of the session. On analysis, we found an overall pattern of synchrony in both non-content and content conversational synchrony measurement across probe sessions in all four participant pairs with some variability in scores. Figure 5.4 represents non-content conversational synchrony scores of the four participant pairs across baseline, treatment probe, and maintenance sessions. Ms. C and Suma showed synchrony during three treatment probes and in one maintenance session. Mr. Bear and Martha showed synchrony in one baseline session, three treatment probes, and two maintenance sessions. Mr. David and Martha showed synchrony in two baselines, three treatment probes, and four maintenance sessions. Finally, Mr. Depot and Martha showed synchrony in one baseline, two treatment probes, and one maintenance session. Thus, analysis of non-content synchrony revealed that although there was variable synchrony across sessions, the scores did not improve with the introduction of the treatment.

Content conversational synchrony. The transcribed conversation samples were coded for interactional discourse resources (IDRs) including playful episodes, narratives, procedural discourses, and reformulations. The frequency of words and gestures produced within the IDRs early in the conversation was compared to that in the later part of the conversation. To determine

whether the pair became more similar in the conversational content by the end of conversation, a content synchrony score was calculated by the same formula as before. Similar to the non-content synchrony, results were found to be variable for content synchrony as well. Figure 5.5 represents content conversational synchrony scores of the four participant pairs across baseline, treatment probe, and maintenance sessions. Ms. C and Suma showed content synchrony in two baseline sessions, one treatment probe, and two maintenance sessions. Mr. Bear and Martha showed synchrony in two treatment probes, and three maintenance sessions. Mr. David and Martha showed synchrony in four baselines, one treatment probe, and four maintenance sessions. Finally, Mr. Depot and Martha showed synchrony in two baselines, three treatment probes, and two maintenance sessions. Therefore, similar to non-content synchrony, content-synchrony analysis also showed that the pairs were variably synchronous, but that did not improve with the onset of treatment. Although the content synchrony scores were variable, the four participant pairs showed a high number of IDR use in all the conversation probes, with the overall highest number of IDRs being the reformulations (71% of the total IDRs), followed by playful episodes (19%), conversational narratives (9%), and procedural discourse (1%). Table 5.9 summarizes the total IDRs used in the conversation probes by the four participant pairs across sessions.

Table 5.9

Interactional Discourse Resources (IDR) in conversation probes across four participant pairs.

	Ms. C				**Mr. Bear**				**Mr. David**				**Mr. Depot**			
#	**PE**	**CN**	**PD**	**R**	**PE**	**CN**	**PD**	**R**	**PE**	**CN**	**PD**	**R**	**PE**	**CN**	**PD**	**R**
BS 1	7	3	1	32	5	8	0	43	11	3	0	31	8	2	1	28
BS 2	16	3	2	40	8	10	1	69	4	5	0	65	10	4	1	18
BS 3	7	2	1	39	8	8	0	36	14	6	0	62	14	4	0	22
BS 4	6	0	2	38	9	6	1	42	10	2	0	33	11	1	1	38
BS 5	7	2	2	28	4	6	0	45	12	5	0	46	10	4	0	17
P 1	8	5	0	39	10	6	2	43	4	3	0	39	10	3	0	29
P 2	6	2	2	28	10	6	2	43	7	5	0	36	8	4	0	34
P 3	9	4	1	30	12	6	0	43	9	3	2	35	10	3	1	17
P 4	10	2	0	23	9	9	0	39	6	5	0	24	9	3	0	28
P 5	7	0	2	36	14	4	0	26	8	3	1	18	9	3	1	21
MS 1	5	1	1	35	13	8	0	47	5	5	1	27	6	2	0	17
MS 2	7	0	2	29	8	6	1	38	1	2	0	17	7	3	2	34
MS 3	8	4	1	28	12	7	0	36	4	3	1	12	11	5	0	30
MS 4	6	0	3	25	5	6	0	27	8	5	0	23	12	5	0	27
MS 5	13	4	0	21	9	7	1	38	7	3	1	35	13	3	0	22
Total	**122**	**32**	**20**	**471**	**136**	**103**	**8**	**615**	**110**	**58**	**6**	**503**	**148**	**49**	**7**	**382**

*PE: Playful Episodes; CN: Conversational Narratives; PD: Procedural Discourses; and R: Reformulations

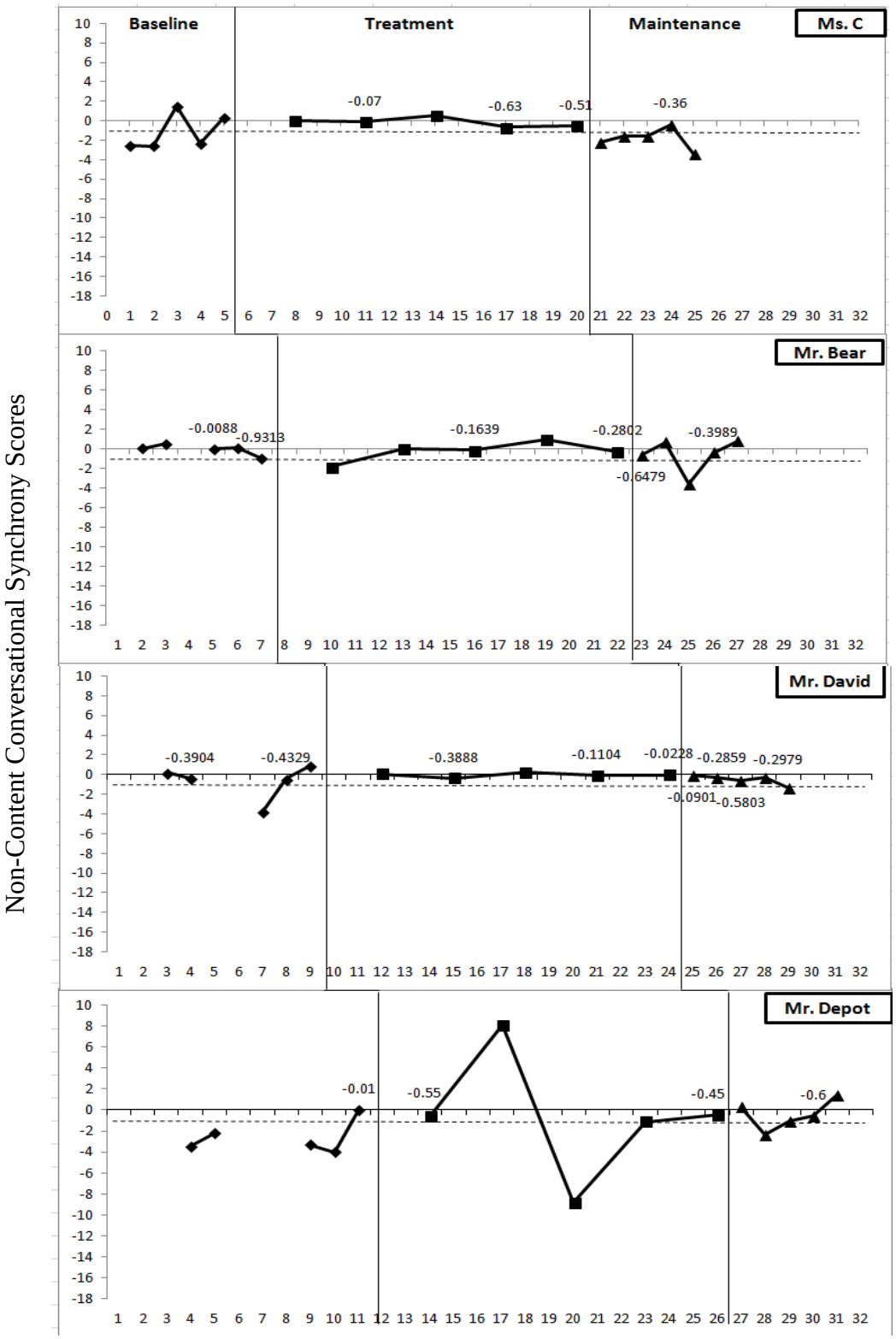


Figure 5.4. Non-content conversational synchrony scores of the four participant-pairs in baseline, treatment probe and maintenance sessions. (Note: Synchrony occurs between 0 and -1, marked here by the dotted line; scores with successful non-content synchrony are labeled)

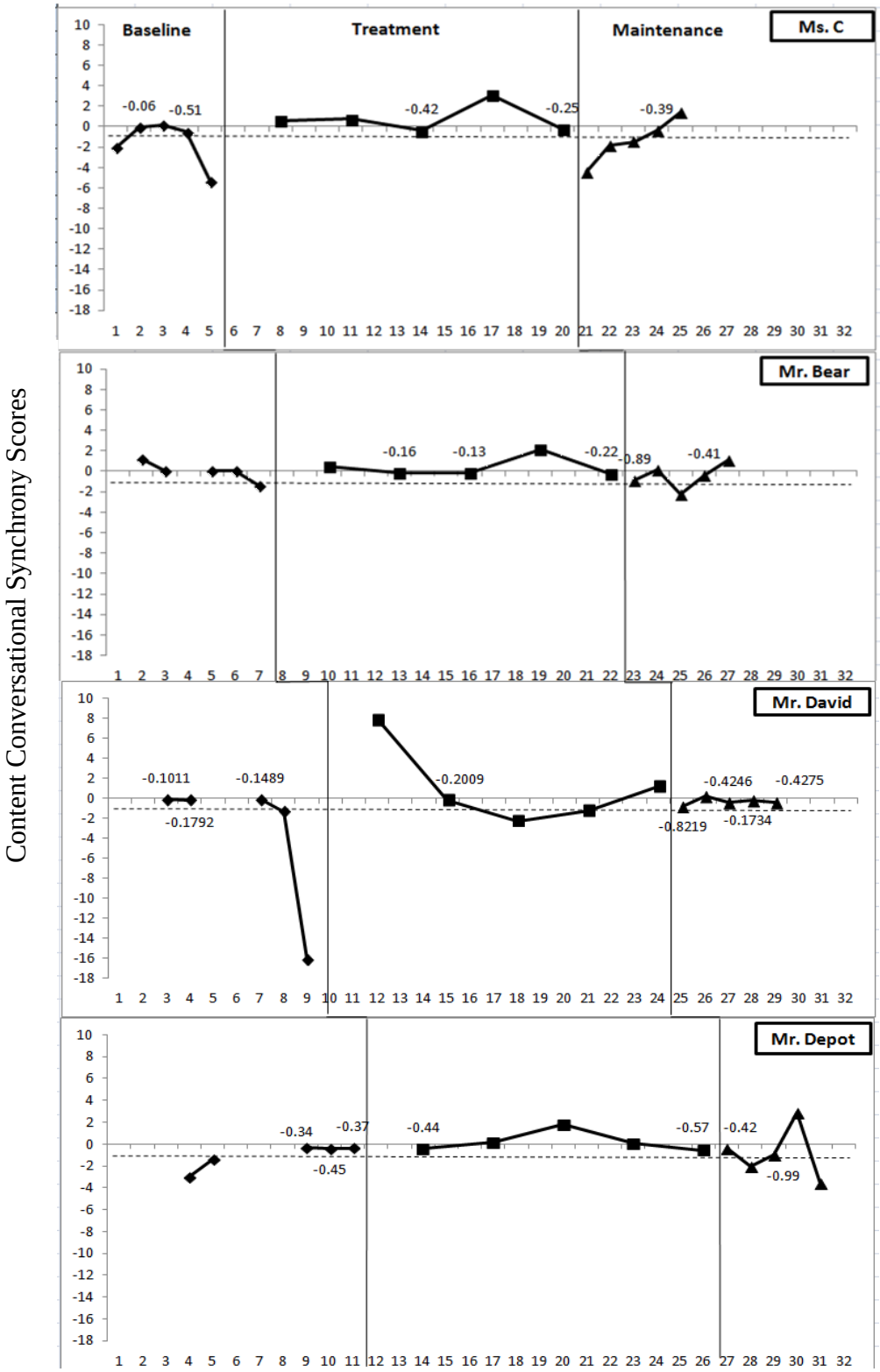


Figure 5.5. Content conversational synchrony scores of the four participant-pairs in baseline, treatment probes, and maintenance sessions. (Note: Synchrony occurs between 0 and -1, marked here by the dotted line; scores with successful content conversational synchrony are labeled)

Social validity. The interviews conducted at the end of the study to assess social validity were analyzed by observing the videotaped sessions. The target participants, their caregivers, and clinician partners were asked questions about how important the treatment goal was to them, if there was any impactful change in communication in everyday life, would they adapt the treatment in any way to continue it at their homes, and how practical/cost-effective the treatment was. The findings from the interviews are discussed below.

Ms. C and Suma. Ms. C was a very motivated and career-oriented woman, and her communication goal was to be able to continue her research and teaching jobs at the university. Ms. C could drive independently and her husband (the primary caregiver) did not attend any study sessions with Ms. C. During the interview, Ms. C expressed that she enjoyed the treatment mainly because there were many opportunities for socialization. However, she reported that the six trials in each treatment session and the repetition of the cards were tiring and uninteresting. Ms. C noted that she enjoyed talking about her family by the use of pictures, but she reported that it would have been more challenging and interesting for her if we had included her research in the pictures. She reported that the she finds herself talking more fluently after the treatment sessions, and that she can speak out her thoughts more easily than before. By the end of the study, Ms. C had started attending research seminars, and reading science journals and magazines. She stated that these effects were very important to her as she can now talk about her research work more fluently and plan about getting back to work in the near future. The clinician (Suma) also noted that the treatment is practical. Ms. C also reported that she would adapt this treatment by using some of her research articles and play the game with her husband at home.

Mr. and Mrs. Bear, and Martha. Mr. Bear and his wife attended the study sessions together. Mr. Bear's communication goal was to be able to talk easily with his family, especially with his grandchildren. During the interview, Mr. Bear reported that the treatment was very entertaining, and that it has had an immense positive effect on his ability to talk with people in his daily life. They stated that some of Mr. Bear's friends at Church noticed significant changes in his ability to name people and places, which were the most difficult for him prior to the study. Mr. and Mrs. Bear noted that the main goal of this treatment, i.e., to improve communication abilities in everyday life, was very important for them. Mrs. Bear reported that she can play the barrier task at home with her husband, and she can also involve the grandchildren in the game. During the interview, Martha noted that she initially thought that the game could be tiring for the

participants, but later realized that the conversations during the game made it less intensive and more enjoyable. She reported that the treatment can be easily adapted to fit the goals of the session and is practical in different settings including inpatient and outpatient rehabilitation units, and skilled nursing facilities.

Mr. and Mrs. David, the personal aide, and Martha. Mr. David was often accompanied by his personal aide, and occasionally by his significant other for the study sessions. During the interview, Mrs. David reported that Mr. David has been very motivated to attend all the treatment sessions, and attended the sessions even on days when he was not feeling very well. The personal aide, who observed all the treatment sessions, reported that she noticed a significant change in the way Mr. David identified and described the pictures by producing the labels more easily. Mrs. David noted that considering Mr. David's love for talking to people, the goal of the treatment was very important for them. The main treatment effect that they noticed was reported to be his ability to describe his own life story more cohesively than ever before. The conversations about his service in the marines that came up during the treatment sessions allowed Mr. David to reflect on it and talk more fluently about it. Martha reported that she was initially concerned when the sessions were going slower and there were difficulties in accurately placing the pictures on the numbers. But as the sessions progressed, she reported that she and Mr. David used many strategies such as gestures and reviewing the pictures to ensure successful placement of the pictures. Thus, she reported it was a great learning experience about successful communication.

Mr. and Mrs. Depot, and Martha. Mr. and Mrs. Depot regularly attended the study sessions together. Mr. Depot's communication goal was to have fluent conversations with his family and friends at church. During the interview, Mr. Depot reported that he was really worried about his performance in the game initially, but his confidence grew as the sessions progressed. Mr. and Mrs. Depot reported that the use of pictures from their life was very functional and thoughtful. Some of the favorite topics of conversation of Mr. Depot were antiques and fossils, construction work, and world events. Mr. Depot reported to have become more confident and fluent in participating in discussions on such topics. Mrs. Depot reported that the treatment effects were so significant that Mr. Depot's mother and other family and friends had commented on his improvement at communication. Mr. and Mrs. Depot also reported that they felt more respected with this treatment than with any other speech language therapy that they had received

before. They enjoyed the treatment so much that they reported to have adapted the treatment for using at home. Martha also reported that although the barrier task is a structured activity, it can be adapted in different ways to achieve various cognitive/linguistic goals, or activity/participation goals.

Patient–Reported Outcome Measures of Communicative Changes in Everyday life

Patient reports of communicative changes in everyday life were documented across the study sessions (twice during baseline and maintenance phases, and three times during the treatment phase) using two measures— Conversation Profile (adapted CAPPA; Whitworth, Perkins, & Lesser, 1997) and Communication Confidence Profile (CCRSA; Babbitt & Cherney, 2010).

Conversation Profile. During the conversation profile assessment, the target PWA and caregivers were interviewed by asking yes/no questions about conversations in their everyday life based on the adapted CAPPA protocol (see Appendix E). To determine the communicative changes throughout the study, the participants were asked to refer to their contact diary when answering these questions. The caregivers/spouses were present during all the conversation profile assessments, and they participated by reminding some of the situations/topics that the target PWA could not think of during the assessments. Table 5.10a and 5.10b shows the changes in the conversation profiles reported by the four participants across the study sessions. The "yes" responses are coded as "+", and "no" responses are coded as "-". The + and - responses are also color coded for different participants. The "+" and "-" responses were also analyzed further to examine constructive changes during the sessions, by comparing the responses to the pre-stroke profile. Any change in "+" or "-" that was similar to the pre-stroke profile was considered a *constructive change*. For example, for the question "can you start conversations easily?", Ms. C responded *no* in BS1, BS5, and probe-1 sessions. But she reported *yes* from Probe 2 onwards. This change was considered constructive because this matched with her pre-stroke response to the same question. Similarly, for the question "are you hesitant to talk to people?" Mr. David had responded *yes* in the two BS sessions, and *no* on probe-1 session onwards. This change was also considered constructive because he had reported not being hesitant prior to stroke. The total number of constructive changes in each participant across sessions was plotted on a graph (see Figure 5.6)

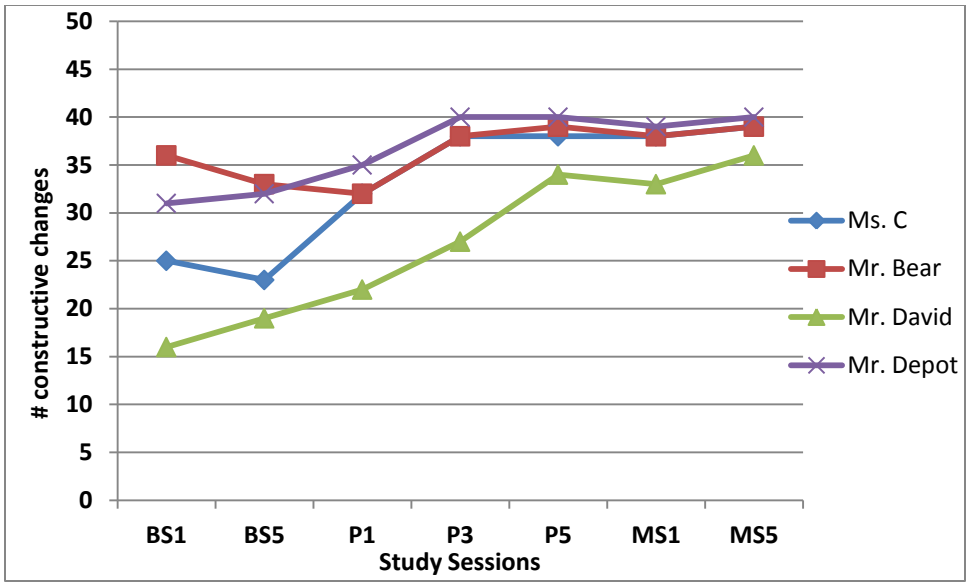


Figure 5.6. Number of constructive changes for four PWA across sessions (on adapted CAPPA).

Overall, the conversation profiles appeared to become more similar to the pre-stroke profile, with more number of constructive changes across study sessions in all four participants with aphasia. The total raw scores and mean constructive-change per session for each participant are described in Table 5.11a and Table 5.11b. For Ms. C, the mean constructive change increased from 61% in baseline-1 to 95% in maintenance-5 session; for Mr. Bear the mean constructive change increased from 87% in baseline-1 to 95% in maintenance-5 session; for Mr. David the mean constructive change increased from 39% in baseline-1 to 87% in maintenance-5 session; and for Mr. Depot, the mean constructive change increased from 75% in baseline-1 to 97% in maintenance-5 session.

Specifically, Ms. C reported constructive changes after the onset of treatment with respect to becoming more talkative, articulate, humorous, starting conversations easily, talking to neighbors and visitors, having conversations during mealtimes, and playing games. Ms. C, who was a research faculty member, reported that she was able to attend meetings and social clubs, and discuss her own and others' research articles with her husband who was also a professor at the same university. During the treatment phase, she also reported having started talking about work, politics and finances, and making plans for future. Mr. Bear, who took his grandchildren to every game, reported that he was able to cheer for them while they played. Mr. Bear reported that subsequent to the treatment, he was starting conversations easily, being less serious and starting to talk to neighbors. With a more severe form of aphasia, Mr. David reported that he was

getting better at listening to people, being more humorous just like his previous personality, speaking more clearly, talking about less serious topics, being less hesitant to talk and less argumentative, using swear words less often, talking more with grand-children, neighbors, and visitors, able to answer the telephone and call people by himself, and able to talk in shops. He also reported to be able to talk more about news/television, work, politics, sports, and finances. Finally, Mr. Depot who was passionate about the world issues was able to talk about his favorite topics again, and manage communications independently at restaurants and shops. Mr. Depot reported that he was able to start conversations more easily, able to argue more, talk to children and neighbors more easily, and able to talk at shops, meetings and social clubs. Overall, the four participants showed diverse conversation profiles by the end of the study, indicating a varied conversation styles and an increased communicative participation in a wide variety of situations, topics, and people.

Table 5.10a

Conversation profiles of the four participants with aphasia (on adapted CAPPA) (Part 1) (Red-Ms. C; Blue-Mr. Bear; Orange-Mr. David; Green-Mr. Depot)

Adapted CAPPA Profile		Pre-stroke	BS 1	BS 5	Probe 1	Probe 3	Probe 5	MS 1	MS 5
Styles of conversation	Talkative	+ + + +	- + + +	- + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Good listener	+ + + +	+ + - +	+ + - +	+ + - +	+ + + +	+ + + +	+ + + +	+ + + +
	Articulate	+ + + +	- + - +	- + - +	- + - +	+ + - +	+ + - +	+ + - +	+ + - +
	Humorous	+ + + +	- + - +	- + - +	- + - +	+ + - +	+ + + +	+ + + +	+ + + +
	Enjoy talking to people	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Speak clearly	+ + + +	+ + - +	+ + - +	+ + - +	+ + - +	+ + + +	+ + + +	+ + + +
	Start conversation easily	+ + + +	- - - -	- - - -	- + - +	+ + - +	+ + - +	+ + - +	+ + - +
	Dominant	+ + - +	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
	Serious	+ - - +	+ + + -	+ + + -	+ + + -	+ + + +	+ - + +	+ - - +	- - - +
	Hesitant	- - - -	- - + -	- - + -	- - - -	- - - -	- - - -	- - - -	- - - -
	Argumentative	- + - +	+ - + +	+ - + -	- - + -	- - - +	- - + +	- - - +	- - - +
	Use swear words	- - + -	- - + -	- - + +	- - + -	- - - -	- - - -	- - + -	- - - -
People	Spouse	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Children	+ + + +	+ + + -	+ + + -	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Grand-children	- + + +	- + - +	- + + +	- + + +	- + - +	- + + +	- + + +	- + + +
	Other family members	+ + + +	+ + - +	- - - +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Friends	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Neighbors	+ + + +	- - - -	- - - -	+ + + -	+ - + +	+ + + +	- + + +	+ + + +
	Strangers	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +

Table 5.10b

Conversation profiles of the four participants with aphasia (on adapted CAPPA) (Part 2) (Red-Ms. C; Blue-Mr. Bear; Orange-Mr. David; Green-Mr. Depot)

Adapted CAPPA Profile		Pre -stroke	BS 1	BS 5	PROBE 1	PROBE 3	PROBE 5	MS 1	MS 5
Situation	Answering telephone	+ + + +	+ + - +	+ + - +	+ + - -	+ + + +	+ + + +	+ + + +	+ + + +
	Ringing people	+ + + +	+ + - +	+ + - +	+ + - +	+ + - +	+ + + +	+ + - +	+ + + +
	At home with family	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	At home with visitors	+ + + +	- + - +	- + - +	- + - +	+ + + +	+ + + +	+ + + +	+ + + +
	Answering the door	+ + + +	+ + - +	+ + - +	+ + - +	+ + - +	+ + + +	+ + + +	+ + + +
	In shops	+ + + +	+ + - -	+ + - +	+ + - +	+ + + +	+ + + +	+ + - +	+ + + +
	Attending meetings	+ + + +	- + - -	- - - -	- + - +	- + - +	- + + +	+ + - -	+ + - +
	At social clubs	+ - + +	- - - -	- - - -	- - - +	- - - +	- - - +	- - - +	+ - - +
	At mealtime	+ + + +	- + + +	- + + +	- + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Visiting families	+ + + +	+ + - +	- + - +	+ + - +	+ + - +	+ + - +	+ + - +	+ + + +
	Playing board games	+ + + +	- + + -	- - + -	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
Topics	News/Television	+ + + +	+ + - +	+ + - +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Plans for future	+ + + +	- + - +	- + - +	+ + - +	+ + - +	+ + + +	+ + + +	+ + + +
	Work	+ + + +	- + - +	- + + +	- + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Politics	+ + + +	- + - +	- + - +	+ + + +	+ + + +	+ + - +	- + - +	+ + + +
	Religion	- + - +	- + - -	- + - +	- + - -	- + - +	- + - +	- - - +	- + - +
	Family	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Friends/Other people	+ + + +	+ + + +	+ + - +	+ + - +	+ + - +	+ + + +	+ + + +	+ + + +
	Past events	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Sports	- + + +	- + - +	- + + +	- + - +	- + + +	- + + +	+ + + +	- + + +
	Daily routine	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	Finances	+ + + +	- + - +	- + + +	+ + - +	+ + + +	+ + + +	+ + + +	+ + + +

Table 5.11a

Raw scores and mean scores of constructive changes in conversation profiles of Ms. C and Mr. Bear across study sessions.

	Ms. C							Mr. Bear						
Conversation Profile	**BS1**	**BS5**	**P1**	**P3**	**P5**	**MS1**	**MS5**	**BS1**	**BS5**	**P1**	**P3**	**P5**	**MS1**	**MS5**
Conversation Style	6	6	8	11	11	11	10	8	8	9	9	10	10	10
Mean	0.5	0.5	0.667	0.917	0.917	0.917	0.833	0.667	0.667	0.75	0.75	0.833	0.833	0.833
People	6	5	7	7	7	7	7	6	5	7	6	7	7	7
Mean	0.857	0.714	1	1	1	1	1	0.857	0.714	1	0.857	1	1	1
Situations	6	5	7	9	9	10	11	11	9	11	11	11	11	11
Mean	0.545	0.455	0.636	0.818	0.818	0.909	1	1	0.818	1	1	1	1	1
Topics	7	7	10	11	11	10	11	11	11	11	11	11	10	11
Mean	0.636	0.636	0.909	1	1	0.909	1	1	1	1	1	1	0.909	1
TOTAL	**25**	**23**	**32**	**38**	**38**	**38**	**39**	**36**	**33**	**38**	**37**	**39**	**38**	**39**
MEAN	**0.61**	**0.561**	**0.78**	**0.927**	**0.927**	**0.927**	**0.951**	**0.878**	**0.805**	**0.927**	**0.902**	**0.951**	**0.927**	**0.951**

Table 5.11b

Raw scores and mean scores of constructive changes in conversation profiles of Mr. David and Mr. Depot across study sessions.

	Mr. David							Mr. Depot						
Conversation Profile	**BS1**	**BS5**	**P1**	**P3**	**P5**	**MS1**	**MS5**	**BS1**	**BS5**	**P1**	**P3**	**P5**	**MS1**	**MS5**
Conversation Style	4	4	5	6	8	10	9	9	8	9	11	11	11	11
Mean	0.333	0.333	0.417	0.5	0.667	0.833	0.75	0.75	0.667	0.75	0.917	0.917	0.917	0.917
People	4	5	7	6	7	7	7	5	5	6	7	7	7	7
Mean	0.571	0.714	1	0.857	1	1	1	0.714	0.714	0.857	1	1	1	1
Situations	3	3	3	6	9	6	9	7	8	10	11	11	10	11
Mean	0.273	0.273	0.273	0.545	0.818	0.545	0.818	0.636	0.727	0.909	1	1	0.909	1
Topics	5	7	7	9	10	10	11	10	11	10	11	11	11	11
Mean	0.455	0.636	0.636	0.818	0.909	0.909	1	0.909	1	0.909	1	1	1	1
TOTAL	**16**	**19**	**22**	**27**	**34**	**33**	**36**	**31**	**32**	**35**	**40**	**40**	**39**	**40**
MEAN	**0.39**	**0.463**	**0.537**	**0.659**	**0.829**	**0.805**	**0.878**	**0.756**	**0.78**	**0.854**	**0.976**	**0.976**	**0.951**	**0.976**

Communication Confidence Profile. During the communication confidence profile assessment, the researcher instructed the target PWA to rate his confidence at specific communicative tasks by pointing to a number on an 11-point scale of 0 to 100 based on the CCRSA protocol (Babbitt & Cherney, 2010) (see Appendix D). The caregiver/spouses attended all the seven confidence profile assessments (2-BS, 3-treatment probe, and 2-MS), but they did not participate in answering or helping the target PWA. The researcher repeated the questions when the target PWA appeared confused or asked for clarification. A total score of confidence across sessions for all four participants are depicted in Figure 5.7. The total score (out of 1000) appears to increase for all four participants with aphasia across the sessions. Although the confidence levels are different for the four participants initially, they begin to merge as the sessions progress. Specifically, Mr. Bear and Ms. C (who had relatively milder forms of aphasia) seem to be more confident initially than Mr. David or Mr. Depot who fall under the moderate to severe range of aphasia. Nevertheless, all the four participants report a steady increase in confidence levels to carry out conversations, to manage one's life and to communicate using the media.

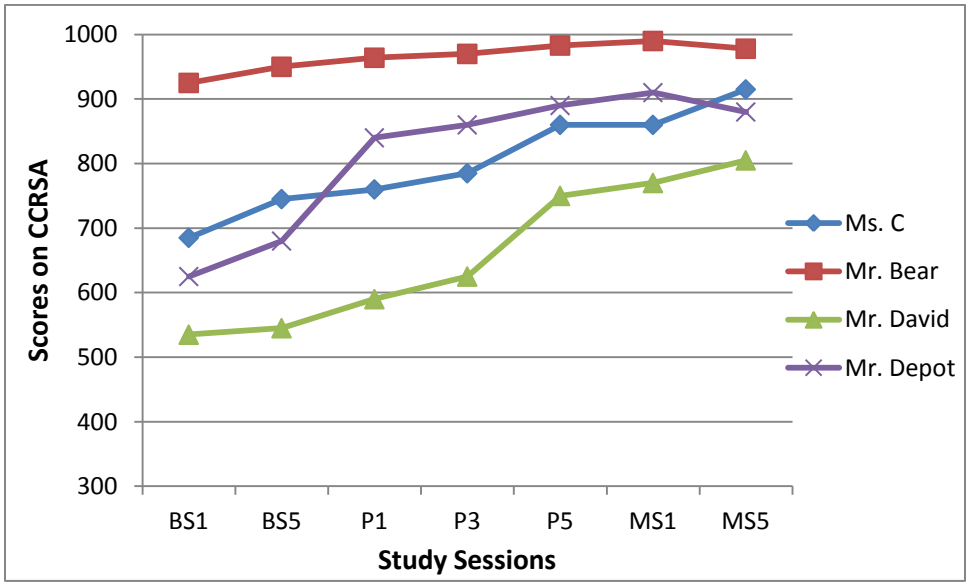


Figure 5.7. Total scores on CCRSA for the four participants across study sessions

The results of the communication confidence profile across the sessions are also summarized by displaying the total scores and mean scores in Table 5.12a and Table 5.12b. The mean scores of communication confidence also increase for all participants across sessions. Specifically, Ms. C reports an increase in confidence from 68.5% in BS-1 to 91.5% in MS-5

session. Ms. C's chief concern initially was that people failed to understand her talk, and therefore she did not feel confident talking to people by herself. By the end of the study, Ms. C reported that she became more confident talking to people, she did not shy away from having independent conversations, be it having small talk with strangers, or having an in-depth discussion about her research articles with her husband. Mr. Bear reported an increase in confidence from 92.5% in BS-1 session, to 97.8% in MS-5 session. Despite the similar profiles of Ms. C and Mr. Bear, it is surprising to see the different levels of confidence they reported throughout the sessions. Mr. Bear, who spent most of his time with his wife and grandchildren, was mainly concerned about not being able to talk easily with his grandchildren. But throughout the sessions, Mr. Bear reported that he gradually felt more confident and was able to talk about strategies to win the games. He also reported that the grandchildren were listening to what he said more often now than before. Mr. David reported an increase in confidence from 53.5% in BS-1 to 80.5% in MS-5 session. Mr. David's inability to understand and manage finances was one of his main concerns. This inability had put him into serious legal situations, but over the course of the study his confidence increased to 90% in participating in discussions related to his money. Mr. Depot reported an increase in confidence from 62.5% in BS-1 to 88% in MS-5 session. Mr. Depot's chief concern was that he was too dependent on his wife as an interpreter, and that he did not feel confident talking to people by himself. By the end of the study, he had started speaking for himself, feeling up to 95% confident doing it. Overall, the four participants reported a significant increase in confidence throughout the study sessions.

Table 5.12a

Raw Scores and Mean scores of communication confidence profiles of Ms. C and Mr. Bear

Confidence Profile	Ms. C							Mr. Bear						
	BS1	**BS5**	**P1**	**P3**	**P5**	**MS1**	**MS5**	**BS1**	**BS5**	**P1**	**P3**	**P5**	**MS1**	**MS5**
	60	60	65	80	75	85	85	75	100	99	95	99	99	100
Conversations	90	100	100	100	100	90	85	90	100	100	100	99	100	95
	40	40	50	65	75	85	90	90	90	95	90	100	99	99
Total	**190**	**200**	**215**	**245**	**250**	**260**	**260**	**255**	**290**	**294**	**285**	**298**	**298**	**294**
Mean	**63.33**	**66.67**	**71.67**	**81.67**	**83.33**	**86.67**	**86.67**	**85**	**96.67**	**98**	**95**	**99.33**	**99.33**	**98**
	90	100	85	85	100	85	100	100	100	100	100	100	100	100
Managing one's life	55	65	65	65	75	75	90	90	90	90	95	95	95	95
	80	80	100	100	100	90	90	100	90	100	100	100	100	100
Total	**225**	**245**	**250**	**250**	**275**	**250**	**280**	**290**	**280**	**290**	**295**	**295**	**295**	**295**
Mean	**75**	**81.67**	**83.33**	**83.33**	**91.67**	**83.33**	**93.33**	**96.67**	**93.33**	**96.67**	**98.33**	**98.33**	**98.33**	**98.33**
	60	70	65	75	75	85	85	100	100	100	100	100	99	100
Communication with media	60	80	90	55	100	90	100	100	100	100	95	100	99	99
	60	70	70	65	80	90	100	90	90	90	95	95	99	95
	90	80	70	95	80	85	90	90	90	90	100	95	100	95
Total	**270**	**300**	**295**	**290**	**335**	**350**	**375**	**380**	**380**	**380**	**390**	**390**	**397**	**389**
Mean	**67.5**	**75**	**73.75**	**72.5**	**83.75**	**87.5**	**93.75**	**95**	**95**	**95**	**97.5**	**97.5**	**99.25**	**97.25**
TOTAL	**685**	**745**	**760**	**785**	**860**	**860**	**915**	**925**	**950**	**964**	**970**	**983**	**990**	**978**
MEAN	**68.5**	**74.5**	**76**	**78.5**	**86**	**86**	**91.5**	**92.5**	**95**	**96.4**	**97**	**98.3**	**99**	**97.8**

Table 5.12b

Raw Scores and Mean scores of communication confidence profiles of Mr. David and Mr. Depot

Confidence Profile	Mr. David							Mr. Depot						
	BS1	**BS5**	**P1**	**P3**	**P5**	**MS1**	**MS5**	**BS1**	**BS5**	**P1**	**P3**	**P5**	**MS1**	**MS5**
	100	60	60	70	90	90	95	30	60	90	70	75	85	80
Conversations	80	70	80	65	90	90	95	30	35	80	75	85	85	70
	50	70	50	60	70	90	90	55	35	50	75	75	80	80
Total	**230**	**200**	**190**	**195**	**250**	**270**	**280**	**115**	**130**	**220**	**220**	**235**	**250**	**230**
Mean	**76.67**	**66.67**	**63.33**	**65**	**83.33**	**90**	**93.33**	**38.33**	**43.33**	**73.33**	**73.33**	**78.33**	**83.33**	**76.67**
	50	50	60	70	85	85	95	90	80	90	95	100	95	95
Managing one's life	40	50	80	70	90	60	70	70	55	90	90	95	95	90
	50	55	70	80	90	90	90	90	85	90	95	95	95	95
Total	**140**	**155**	**210**	**220**	**265**	**235**	**255**	**250**	**220**	**270**	**280**	**290**	**285**	**280**
Mean	**46.67**	**51.67**	**70**	**73.33**	**88.33**	**78.33**	**85**	**83.33**	**73.33**	**90**	**93.33**	**96.67**	**95**	**93.33**
	30	50	70	60	70	90	90	50	80	90	80	85	90	90
Communication with	0	0	0	0	0	0	0	60	80	90	95	95	95	95
media	90	80	70	75	90	90	90	90	90	90	95	95	95	95
	45	60	50	75	75	85	90	60	80	80	90	90	95	90
Total	**165**	**190**	**190**	**210**	**235**	**265**	**270**	**260**	**330**	**350**	**360**	**365**	**375**	**370**
Mean	**41.25**	**47.5**	**47.5**	**52.5**	**58.75**	**66.25**	**67.5**	**65**	**82.5**	**87.5**	**90**	**91.25**	**93.75**	**92.5**
TOTAL	**535**	**545**	**590**	**625**	**750**	**770**	**805**	**625**	**680**	**840**	**860**	**890**	**910**	**880**
MEAN	**53.5**	**54.5**	**59**	**62.5**	**75**	**77**	**80.5**	**62.5**	**68**	**84**	**86**	**89**	**91**	**88**

Summary

This mixed methods study revealed three salient findings: (i) successful collaborative referencing across four participants with aphasia and clinician-partners determined by the high accuracy of card placement, reduced collaborative effort, and simplification of referencing expressions, and also successful collaborative learning determined by a high frequency of conversational repetition of referencing expressions; (ii) evidence of a functional relation between the barrier treatment protocol and the PWA's naming behaviors (measured by the collaborative confrontation naming task), but no evidence of a functional relation between the BTP and the PWA's conversational behaviors (measured by content- and non-content conversational synchrony); and (iii) patient reports of improved conversation profiles and increased communication confidence consistent across the four participants with aphasia, measured by adapted CAPPA and CCRSA. The next chapter discusses the interpretations from this research, the study's contributions, clinical implications, and future research directions.

Chapter 6

Discussion

Grounded in the distributed communication theory (Hengst, 2015) and the social philosophies of interventions for aphasia (Simmons-Mackie, 2001), this study employed a mixed methods design, combining an interpretive case-study with an embedded multiple-probe single-case experimental design. The aim of the present study was to examine the changes in aphasic participants' communicative patterns during the study sessions, both during the treatment itself (i.e., successful collaborative referencing during the barrier treatment protocol), and during naming and conversation probes (i.e., single-case experimental design), as well as outside of the study sessions (i.e., patient reports of conversation profiles and communication confidence). Overall, triangulation of findings from the mixed methods design suggests that the verbal learning evidenced within the barrier treatment sessions (from the ATL and IRE analysis) was generalized to the clinical naming task (CCN score analysis); increased participation in communicative activities was evidenced within study sessions from the conversational synchrony analysis and discourse analysis of use of communicative resources, and also outside study sessions from the patient-report analysis of adapted CAPPA; finally, increased communication confidence was evidenced by the patient-report analysis of CCRSA and the discourse analysis of IREs. This chapter discusses the main contributions of this study: (i) proposing the barrier treatment protocol (Hengst, Duff & Dettmer, 2010) as a social-based intervention; (ii) the value of mixed methods in treatment research; (iii) significance of patient-reported outcome measures; (iv) implications for aphasia treatment and recovery. Future research directions are also described.

Barrier Treatment Protocol as a Social-based Intervention

Consistent with the literature on the barrier treatment protocol (e.g., Hengst et al., 2010), this study supports earlier findings that engaging in collaborative referencing leads to positive communicative changes in participants with chronic aphasia. The barrier treatment protocol is proposed as a social-based intervention because: it applies the principles of social approaches (Simmons-Mackie, 2008) to therapy, it takes a socio-cultural perspective to communication (i.e., the distributed communication theory; Hengst, 2015), and by designing a collaborative referencing activity with multiple opportunities for repeated engagement, the BTP is grounded in the social learning theory (Vygotsky, 1978).

Here, I discuss how the BTP fits well with the nine principles (Simmons-Mackie, 2008) that conceptualize a social approach to aphasia management: (a) Going beyond the mere exchange of information (or successful communication of labels), the four participants in this barrier treatment study engaged in sharing humor and narratives, building identities, and connecting with each other, thus meeting the *dual goals of transaction and interaction*; (b) Although the treatment was conducted at a speech-language pathology clinic, it served as *an authentic context* because the barrier treatment has been set up as a game, with clinicians and patients in the roles of participants. Unlike decontextualized clinical tasks, the game provided opportunities for participants to engage in complex and dynamic communication; (c) Shifting the focus away from the so-called "language norms", the barrier treatment encouraged the participants to communicate in *any modality*. Regardless of who the director was, the focus of the game was to get the treatment-cards on the right numbers, and not on whether the patient was able to produce the label accurately or not. Consequently, the discourse analysis focused on examining the *dynamic* changes in the labels across trials as opposed to the aphasic language deficits; (d) Designed as a *collaborative* referencing activity, participants in the barrier treatment collaborated to develop and use labels for the treatment-cards and to complete the task; (e) Although the goal of the game was to place the treatment-cards on the right numbers as the director's, the participants were encouraged to share stories and to *have conversations* throughout the task. In the present study, such conversations developed mainly from the people, place and pictures involved, and they included a variety of topics such as, the weather, food, culture, events from the past, current world issues, and health; (f) The patient-reported outcome measures were used to discuss issues related to *personal* (e.g., communication confidence) and *social* (e.g., participation in social activities) *consequences* of aphasia, and to track changes in these issues after the onset of treatment; (g) The participants collaborated to develop labels for each photo-card during the treatment sessions. During this process, the participants with aphasia demonstrated several difficulties in naming pictures. However, their *adaptations* were considered as labels and used communicatively. For example, Mr. Depot had difficulty in naming a picture of a construction tool that he used for building his house. Martha and Mr. Depot ended up calling the picture "the thing"; (h) The *perspective of the participants with aphasia and their caregivers* was considered by allowing them to choose personally significant treatment stimuli and by involving the caregivers in the interviews about changes in conversation profiles; (i) The current

treatment research included *quantitative* data i.e., initial assessment scores (e.g., WAB-AQ); treatment accuracy scores; communicative resources (e.g., words, gestures, time, etc.); naming probe scores (e.g. PICA); conversation synchrony probe scores; and patient-reported outcome scores, and also *qualitative* data such as initial semi-structured interviews, videotaped discourse during the treatment sessions, conversation probe, and social validity interviews.

In addition to adhering to the nine principles of social approach, the barrier treatment protocol fits well as a social intervention also because it is grounded in a socio-cultural theory of communication (i.e., the distributed communication theory; Hengst, 2015). Taking a distributed communication perspective, the barrier treatment protocol offered multiple opportunities for participants to use language, by participating in the embedded *activity* of collaborative referencing. The participants and the partners constructed their own functional systems by collaborating and coordinating with each other to complete the task. For example, the most typical pattern of playing the barrier task that we observed was by matching numbers from 1 through 12. However, Ms. C and Mr. Bear matched the odd numbers first, or even numbers first and had fun with numbers. On the other hand, Mr. David had difficulty with recognizing and verbally expressing numbers. His partner, Martha, employed many communicative strategies, and used various communicative resources to help ensure that the pictures were matched. Within the first few sessions, the two of them had established a new system of matching with the help of gestures (such as, showing one finger) and directions (up and down).

Our participant pairs developed and shared many histories by participating in collaborative referencing activities across 15 sessions. For example, Mr. Depot referred to a treatment card as *"Mr. Depot and the…and the..yellow thing"* in Session 6, and *"the the scaffolding"* in Trial 1 of Session 13, and *"the thing"* in Trial 5 of Session 13. This simplification of the reference was preceded by the numerous conversations that occurred between Martha and Mr. Depot about the nature of the treatment card which had a picture of Mr. Depot working on a construction piece for his house. The complexity of the action/event depicted in the picture led to a struggle for labeling the card, and thus the label— "*the thing*" originated. The common ground built through having such shadow conversations seems to have led to successful communication. These results were consistent with the earlier findings on collaborative referencing in aphasia (Hengst, Duff, & Dettmer, 2010). Finally, we also observed not only multimodal communication, but also the use of several socio-cultural voices: Ms. C and

Suma often shifted alignments from the patient/participant and clinician/researcher voices respectively, to the voices representing an orthodox versus a liberal individual, or to an experienced researcher versus a novice researcher, or to an experienced cook versus a novice cook. For example, in session 7, Ms. C and Suma discuss about the different styles of Indian cooking, where they alternatively assume the roles of an experienced cook and a novice cook as the topic shifts between North-Indian and South-Indian styles of cooking. Therefore, the many roles and identities displayed by the participants indicate that the treatment created a rich communicative space. This theory shifts our focus from isolated individual productions of language (verbal) of the person with aphasia to the functional communication systems managing aphasia. This is also consistent with some of the philosophies of the social approaches to aphasia intervention that encourage researchers and clinicians to focus on the society and communication partners rather than the PWA alone. Therefore, the distributed communication perspective allowed us to analyze and interpret communication in aphasia by considering the context and social environment, and the psycho-social factors.

As a social-based intervention, the barrier treatment protocol provided a rich communicative and therapeutic space by offering opportunities for repeated engagement in collaborative referencing, thus providing evidence for social learning within treatment. One such example comes from the patterns of conversational repetition of the agreed-upon target labels (ATLs) during the barrier task trials, which revealed the opportunities that the treatment provides for meaningful and repeated engagement with the target references. Consistent with the earlier finding (Hengst et al., 2010), a high number of RATLs were documented in the present study as well, with relatively low counts of non-ATLs. For example, Mr. David had difficulty in referencing a treatment card—"football game". In his first session with this treatment card, Mr. David used the ATL only once, but used 7 RATLs and also shared several stories about Michael (his son) enjoying football games. In his last session with the same treatment card, Mr. David was able to use the ATL consistently in all the trials directed by him. The conversational repetition of references supported multiple functions, such as adhering to the rules of the game to repeat, confirming the card, referring to earlier card placements, sharing stories about the card, and engaging in humor or verbal play. Such conversational repetitions occurred without any sustained clinician-directed repetition of isolated target references, thus emphasizing the role of social interactions in learning and development (Vygotsky, 1978). Therefore, the current study

successfully highlights the repeated engagement in collaborative referencing as a therapeutic mechanism of the barrier treatment protocol.

Value of Mixed Methods in Treatment Research

In order to understand communication in aphasia from multiple perspectives, I used a mixed methods design, by combining interpretive case-study design and a multiple-probe single-case experimental design to study patterns of learning and changes in communication abilities during study sessions and outside study sessions. The overarching interpretive case study design offered a platform to study the complex phenomenon of communication and related experiences, by providing opportunities to understand the *process* of communicative change rather than just the *outcome*, by analyzing the contextual variables as the primary data rather than controlling them, and by ensuring the credibility of the data via triangulation from multiple methods and procedures. On the other hand, the embedded multiple-probe single case-experimental design allowed me to conduct a rigorous experimental evaluation of the treatment effects by systematic measurement of a dependent variable before, during, and after the active manipulation of an independent variable. The SCD also allowed me to document a functional relation between the dependent and independent variables, and therefore could be used to establish evidence-based practice for traditional targets (i.e., naming) and generalizable activities (e.g., conversation). According to Kratochwill et al. (2010), the current multiple-probe SCD would meet the evidence standards since the design has a minimum of six phases with five data points in each phase. Therefore, combining these two methods into a mixed methods design gave me an opportunity to collect multiple data using different approaches, leading to complementary strengths and non-overlapping weaknesses.

To study communicative changes in aphasia using the mixed methods design, I adopted the ICF's bio-psychosocial framework, and selected different outcome measures (such as CCN probe, conversational synchrony, patient reported outcome measure etc.) and discourse analysis measures (such as collaborative referencing, initiating referencing expressions, agreed-upon target label, etc.). These measures were strategically embedded in the two research designs, which allowed us to triangulate the findings for further interpretation. In this section, I discuss my interpretations of the findings from the mixed methods study using the ICF framework.

Verbal Learning/Naming (Body Structures and Functions). By combining the results from interpretive discourse analyses (ATL and IRE) and multiple-probe dependent variable

(CCN-collaborative confrontation naming), I interpreted the changes in naming or verbal learning skills of the four participants. The changes in the use of initiating referencing expressions across treatment sessions, such as the simplification of IREs from non-definite referencing expressions to definite referencing expressions, in all the four participant-pairs indicate a pattern of collaborative learning of labels. The learning of labels during treatment is also supported by the agreed-upon target label (ATL) analysis, which showed a successful and consistent use and repetition of labels throughout the treatment sessions by all the participant pairs.

In addition, results from the multiple-probe single-case experimental design contributed significantly to the previous literature on the barrier treatment protocol (e.g., Hengst, 2003; Hengst et al., 2010). Adding the probe to this study gave us an opportunity to capture the effects of BTP on probes (i.e. in an experimentally controlled clinical naming task). As the primary dependent variable, treatment decisions were based solely on the performance in the naming task. The BTP offered numerous opportunities for the participants and the clinician-partners to use names or references of the treatment cards during the treatment sessions. The counts of ATLs and RATLs (p. 85-86) indicate the high level of engagement of the participants in generating and using names of the cards during the 15 sessions. The probe cards used in the naming task included a different perspective or a different view of the picture compared to the treatment cards to avoid adaptation effects. The probes captured the learning effects across the study that is strongly correlated with the treatment, and also captured the maintenance of the learnt behavior post-treatment. Despite the differences in types and severities of aphasia (Ms. C and Mr. Bear were diagnosed with mild anomic aphasia, and Mr. David and Mr. Depot were diagnosed with moderate-severe Broca's aphasia), consistent treatment effects were observed in the study because naming was one of the main language functions affected in all the four participants.

The CCN probe successfully fit not only with the body structures and functions component of the ICF, but also with the constructs of the distributed communication theory. By using the adapted PICA's multidimensional scoring, we: analyzed the probes by considering them as functional systems; accepted multimodal responses and scored them on a hierarchy; considered the responses of all participants including the PWA, clinician, and researcher, rather than scoring PWA's isolated productions alone; and, used personally significant pictures as treatment cards and probe cards, so that they were reflective of the past socio-cultural histories of

the participants with aphasia and also were helpful in building new histories with the clinician-partners. The high inter-rater reliability obtained in this study is consistent with the previous literature using the original PICA scoring system (Porch, 1971).

While the IRE- and ATL-analysis revealed successful verbal learning during-treatment, the significant treatment effect observed in the experimentally controlled multiple-probe design adds to the current literature of the barrier treatment protocol by providing evidence for learning effects with generalization to a clinical naming task. Therefore, this study has successfully revealed the patterns of verbal learning during the barrier treatment protocol, and also revealed that there is a functional relation between the barrier treatment protocol and the PWA's naming behaviors.

Communicative Activities and Participation. I interpreted the participation in communicative activities by combining the results from the interpretive discourse analysis (e.g. communicative resources), multiple-probe secondary dependent variable (conversational synchrony), and patient-reported outcome measure (adapted CAPPA). Since the barrier treatment protocol involves a collaborative activity, the findings from the collaborative referencing analysis were used to interpret the communicative participation abilities as well. The successful participation in the communicative activity by all four participants during treatment was evidenced by the completion of all the barrier task trials, high accuracy of card placements, and reduced use of communicative resources (e.g., words, gestures, etc.).

The results from multiple-probe conversational synchrony measure were used to interpret the participation in communicative activities during probes. We chose the synchrony measure to explore the complex deficits in communication among individuals with aphasia in everyday conversations, and to understand the different ways in which participants adapt and adjust their behaviors in response to their partners. Words and gestures were considered to analyze the non-content conversational synchrony, and interactional discourse resources (IDR) (playful episodes, conversational narratives, procedural discourse, and reformulations) were considered to analyze the content-based conversational synchrony. On analysis, we found the participant pairs to be variably synchronous across sessions in both non-content and content-based conversational synchrony. We believe the reason for varying synchrony scores to be the variability in aphasia types and severities, and limited time for conversation. With diagnoses of fluent aphasias, Ms. C and Mr. Bear dominated conversations during the probe, with little responses and/or feedback

from the clinician-partners. On the other hand, Mr. David and Mr. Depot had a non-fluent type of aphasia, and therefore their conversations included several pause times, non-verbal responses, and clarifications or requests to repeat from the clinician-partner. In addition, the 10-minute time restriction on the synchrony analysis could have been very little time for participants to align with one another, because some of the narratives initiated during the probe were not completed within 10-minutes, and therefore the partners did not get a chance to offer their thoughts. However, there was synchrony among participant-pairs in several sessions throughout the study. But it did not seem to be affected by the introduction of the treatment, as synchrony was documented to be present even before the treatment was initiated, i.e., in some baseline sessions. This finding is in contrast to the earlier finding of no conversational synchrony in adults with TBI (Gordon et al., 2015). This could be related to the social communication deficits documented in TBI (Gordon, Tranel & Duff, 2014), which is absent in aphasia. However, when we measured the conversations for IDRs, we found a high frequency of IDR use throughout the study among all participants despite aphasia. This result is consistent with a previous study on the use of IDRs by students with disabilities (Hengst et al., 2016). Although we did not find a functional correlation between the treatment and the conversational synchrony behaviors of PWA, the findings indicate that synchrony may not be the ideal outcome measure of conversation in aphasia. Further analysis on the conversational samples could provide us with a better understanding of the changes in conversations with the onset of the treatment. These ideas are discussed in the future research directions section below.

Finally, I interpreted the participation in communicative activities outside-treatment by examining the four patient-reports of conversation profiles (adapted CAPPA). Strikingly, the reports showed a consistent increase in communicative participation in different situations and with different topics and people, across participants. In addition, with the multiple-probe experimental controls in place, the effects of the treatment on the patients' communicative participation can be evidenced with more strength, although the patient-reports do not necessarily count as a behavior. Therefore, this study revealed successful participation in communicative activities during study sessions [i.e., during-treatment (successful collaborative referencing), and during probe (variable conversational synchrony)], and also outside of study sessions (adapted CAPPA).

Contextual Factors. To understand the changes in psycho-social well-being (i.e., communication confidence), I combined the results from the patient-reported outcome measure (CCRSA) and the discourse analysis measure (IRE). The analysis of patterns of simplification in the use of initiating referencing expressions revealed expected patterns of decrease in the use of non-definite referencing expressions such as *descriptions*, and increase in the use of definite referencing expressions such as *elementary* and *episodic*, from initial to non-initial trials across sessions. Hengst (2001) reported that the directors with aphasia display a higher variability in the use of IREs than the directors without aphasia. Consistent with this finding, the four participants with aphasia in this study displayed a more diverse use of IREs, including the use of *placeholder*, *installment*, and *proxy*, than the clinician-partners.

The reports of increase in communication confidence in the four participants across the study can be associated with their performance on the collaborative referencing task. The simplification of the IREs during referencing is an indication of high confidence. For example, one of Mr. Bear's IRE was "Queen Dot" for which Martha responded "Ah…got it [laughs]". Initially, the most common IRE for this picture was "Cheryl and Cheryl's mom on her birthday". By the 14th session, Mr. Bear could confidently refer to the same picture as "Queen Dot" because of the past histories shared with Martha that included extended narratives about Dot, the relationships they shared as a family, and about why Dot was referred to as the Queen. Similarly, all the participant pairs displayed an increase in confidence by using simplified referencing expressions within treatment tasks. In addition, the effects of the treatment on the communication confidence of individuals with aphasia are strengthened by the existing experimental controls of the embedded multiple-probe design, although patient-reports cannot be considered measurements of a behavior. The use of CCRSA in this study adds to the literature by providing evidence of improved patients' perceptions of confidence in communication.

In summary, this mixed methods study revealed several complementary strengths and non-overlapping weaknesses such as: (i) the opportunity to study the complete activity (of treatment) including the socio-cultural and historical variables by using the qualitative design, while also studying the individual utterances (in naming probe) by using the experimental control; (ii) the multiple-probe design was set up to measure the transfer or generalization of the learnt behaviors from the treatment to an experimentally controlled task; however, I could circumvent the notion of generalizability by directly analyzing conversations or social

interactions by using the qualitative design; and (iii) the interpretive case study provided evidence for learning within the treatment, with a significant impact on the everyday lives of people with aphasia; and the single-case experimental design provided evidence for significant treatment effects on clinical naming tasks outside treatment. Therefore, the integration of the research designs provided us with a better understanding of the intervention, and how it impacted all the three ICF components of health.

Significance of Patient-Reported Outcome (PRO) Measures

The two PRO measures used in the study were successful in providing the participants' perceptions about two of the ICF components of health— communicative participation in activities (i.e., adapted CAPPA-Conversation Analysis Profile for People with Aphasia; Whitworth, Perkins, & Lesser, 1997), and participants' perceptions of communication confidence (i.e., CCRSA; Babbitt & Cherney, 2010). Patient reports on both of these profiles indicated a positive impact of the treatment on the everyday lives of all participants.

The patient-reports of conversation profile (adapted CAPPA) indicated a striking and consistent increase in communicative activities with varying styles of conversations across participants. The types of constructive changes in conversation profiles varied across participants. For example, Mr. Depot reported that he was often involved in serious conversations (e.g. current events, politics etc.) prior to stroke, and was not able to have such conversations initially, but that changed from Probe 3 onwards. On the other hand, Mr. Bear reported that he liked to have funny and humorous conversations that are not related to serious topics prior to stroke. During the initial sessions, he reported to be mainly involved in serious conversations (related to health and his therapy progress) that did not give opportunities for using humor. Beyond Probe 5, Mr. Bear reported that he had started having less serious conversations. Thus, the adapted CAPPA allowed us to capture the unique successes perceived and reported by the participants.

One of the styles of conversation that three PWAs (Ms. C, Mr. Bear, and Mr. Depot) reported was being a dominant conversationalist prior to their strokes. Interestingly none of the three participants reported any change in this aspect throughout the study. However, the same three participants appeared to be highly communicative within the treatment sessions. This was evidenced by the high number of *everyday talk* instances that were analyzed as part of a research conference presentation on this data (not included in this dissertation) to examine the non-task

related talk that occurs between the participant pairs during barrier task trials. Not only did the participants successfully completed the barrier task trials (evidenced by accurate card placements and reduced collaborative effort), but they also participated in a significant number of everyday talk episodes (outside card placement sequences) during treatment sessions, pointing towards increased participation in everyday conversations.

Although we adapted CAPPA to use it as a patient-reported outcome measure, our findings reveal reported improvements in the profile similar to the findings from Ross et al., (2006). However, using CAPPA as a rating scale with adaptations for individuals with aphasia (e.g., picture-based questions) would possibly be more effective and reliable in terms of determining more accurate perceptions, than the yes/no format that was currently used. Overall, the reports of enriched conversation profiles suggest increased life participation which highlights the significance of treatment effects.

The current study also measured the impact of treatment on one of the psycho-social factors of communication i.e., communication confidence, by using CCRSA. The World Health Organization's International Classification of Functions (2001) incorporates confidence as a measure of temperament and personality functions of an individual. Specifically with regard to aphasia, communication confidence has been considered to be consistent with the quality of life measures. Therefore, the CCRSA was successful in addressing my research questions. For example, one of the questions stated: *how confident are you that you can follow the news,* as opposed to *can you follow the news?* This PRO measure helped us to capture and understand the individual communicative goals of our participants. This measure also helped us to focus on and track the changes perceived by the participants in their personal and social consequences of aphasia. The diverse aspects of confidence measured by the scale gave us insight into the autonomy, participation in life, and quality of life of the participants. For example, *confidence in managing or participating in discussions about finances*, or *confidence in following sports or movies on TV*, etc. indicated the extent to which aphasia had impacted the participants' everyday lives. The results from CCRSA indicated an increase in communication confidence across the study sessions in all four of the participants with aphasia. These results were consistent with the results from Babbitt and Cherney (2010), revealing improved participation and confidence in life activities. To corroborate this evidence, we looked at the simplification of the initiating referencing expressions (IREs) used by the participants for each of the treatment cards, as

indicative of increased confidence in referencing. The shift in the use of non-definite IREs to definite IREs with the progression of treatment sessions can be considered as an increased confidence within-task conditions, and can be correlated with the increase in confidence reported by the participants in their everyday communicative lives. This striking finding indicated a significant impact of the treatment on an important component of the quality of life.

This study has made an attempt to shift from the traditional medical based clinician-centred health care, and move towards getting the patients' perspective. From this perspective, we encourage clinicians and researchers to pay increasing attention to obtaining the patients' reports not only for deciding on and developing treatment plans, but also for measuring health outcomes. This is consistent with the principles of the evidence based practice, which suggests that the patients' perceptions of health and life have to be measured in addition to the available evidence (de Riesthal et al., 2015). Although there is not a complete consensus on the type and extent of PRO measures for aphasia, there is evidence in the medical literature about improved clinician-client communication, improved quality of care, and enhanced treatment related decision-making from using PRO measures (Bevans, Ross, & Cella, 2014; Cella et al., 2010).

Implications for Aphasia Treatment and Recovery

The current treatment study may have some direct clinical implications with respect to treatment methodologies as well as clinical assessments. First, the results suggest that the barrier treatment protocol offers a rich communicative environment that allows participants to use language in a meaningful activity as opposed to a drill-based setting. Based on Vygotsky's social learning theory (1978), repeated engagement serves as a therapeutic mechanism, which consists of not only the multiple opportunities at referencing, but also partner collaborations and social interactions that promote learning. When it comes to partner collaborations, it is important to realign the roles of clinicians from being a lead in drill-based tasks to a skilled communicative partner with clinical goals. Clinicians are even encouraged to consider training and involving family members and caregivers as the collaborative partners in the treatments, since they play a significant role in the communicative worlds of our clients with aphasia. Therefore, clinicians are encouraged to design clinical activities that support repeated engagement in referencing for successful learning. Activities of repeated engagement can also be adapted to different settings (i.e., sub-acute care, outpatient rehabilitation unit etc.) depending on the needs of the clients.

Second, applying the distributed communication theory to a social-based intervention would involve looking past the modular, controlled, and therapist-directed tasks, and considering the socio-cultural and historical variables in designing treatments and goals that are meaningful for clients. With the understanding of functional reorganization in the brain due to rich communicative activities, clinicians have to be creative in adapting the treatments to the needs of the clients and yet maintain its complexity to enhance learning and life participation.

Third, findings from the PRO measures gave us the opportunity to understand what success means to the patients, and thus, they should be taken into consideration for management of aphasia. PROs can be administered as part of assessment, and can be a great resource in developing treatment plans. They also give information about the clients' perception about the treatment effects and treatment satisfaction. In addition, similar to a single-case experimental design, the clinicians can administer PROs regularly before the onset of treatment (as a baseline measure), during the treatment sessions for documenting continued progress, and during the discharge of the clients.

Fourth, one of the main findings from this study is the positive effects of the treatment for aphasia in outside-treatment activities/participation and psycho-social factors. While a majority of the existing aphasia interventions work towards improving within-task language functions, the current study helped in bridging the clinical-functional gap by documenting changes in communication at all the ICF components. This suggests that researchers and clinicians should not only work towards developing and using social-based interventions, but should also use functional measures to assess treatment progress.

Future Research Directions

The aim of this dissertation research was to investigate the communicative changes from the barrier treatment protocol during the study sessions and outside of the study sessions among four individuals with aphasia. The current results of communicative changes during the treatment sessions are consistent with the previous literature indicating successful collaborative referencing. Results also provided strong evidence for learning effects on collaborative confrontation naming. However, although patient-report analysis revealed improved conversation profiles, the adapted CAPPA may not have completely captured all the details of changes in everyday communicative activities of individuals with aphasia. Similarly, the conversational synchrony measure did not successfully capture the learning during conversation

probes. Therefore other outcome measures can be explored in the future to assess changes in communicative activities and participation. One of the ways that we have begun to explore this is with the everyday talk analysis project, in which we are comparing the use of communicative resources for everyday talk as opposed to task-related talk during the treatment sessions. The impact of treatment on everyday communication can also be more directly assessed by conducting a qualitative research study consisting of discourse analysis of conversation samples of participants obtained from different everyday situations. Also, the changes in communication confidence reported by the patients reveal a positive impact of the treatment on the psycho-social factors of individuals with aphasia. Discourse analysis of the conversation samples of participants can be studied in the future to trace the patterns of confidence in discourse.

In addition, the barrier treatment protocol has been studied in adults with chronic aphasia. We need further research to analyze the treatment process in acute and sub-acute population. Also, the existing collaborative referencing research has focused on two-party discourse. The question remains if the collaborations would still be successful in a multi-party discourse (e.g., a group barrier task). This research would also contribute towards highlighting the importance of group-based interventions for aphasia. Another area that has not been explored within the barrier treatment research is whether individuals with language comprehension problems (e.g. Wernicke's aphasia, Transcortical sensory aphasia etc.) can manage to successfully collaborate or not. This research would expand our understanding of repeated engagement as the therapeutic mechanism for verbal learning to language comprehension as well. Finally, given my experience in India and broader processes of globalization, studying multilingual and multicultural factors in social-based interventions would add another dimension to the socio-cultural and historical variables that are already considered in analyzing the barrier treatment.

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Appendix A

Participant Flyer

LOOKING FOR PARTICIPANTS

For a Speech Therapy Research Study

- For adults with *Aphasia* due to strokes or other brain injuries
- The speech therapy protocol uses a collaborative barrier task:
    - clinician and client sit at a table facing each other over a low barrier
    - clinician and client work together to successfully identify and place target photo cards on their playing boards
- The therapy goal is to improve participants' abilities to identify and recall names for different objects, events, locations and people pictured on the cards

Who can participate?

- Adults (>18yrs of age) who were diagnosed with Aphasia at least 6 months ago
- Participants must speak English, OR Hindi, Kannada or any other Indian languages.

Length of Participation

- Participants will be asked to attend a total of 25-30 sessions across 10-12 weeks. We will work with you so that we can schedule 2-3 sessions a week at your convenience.
- We will schedule participants to start anytime between Nov. 2015 – Dec. 2016.

Would you like to know more about this project? Please contact:

Suma Devanga, Doctoral student
Department of Speech and Hearing Science
University of Illinois at Urbana-Champaign
tel: [redacted] email: devanga2@illinois.edu

Julie A. Hengst, PhD CCC-SLP (Principal Investigator)
Associate Professor in the Department of Speech and Hearing Science
901 S. Sixth Street, Champaign IL 61820
tel: [redacted] email: hengst@illinois.edu

Appendix B

Approval Letter from the Institutional Review Board

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Office of the Vice Chancellor for Research

Office for the Protection of Research Subjects
528 East Green Street
Suite 203
Champaign, IL 61820

June 3, 2016

Julie Hengst
Speech & Hearing Science
210 Speech & Hearing Science Bldg
901 South Sixth Street
Champaign, IL 61820

RE: *An Innovative Clinical Intervention for adult-acquired cognitive-communication disorders: A feasibility study of a protocol using collaborative referencing tasks and clinicians as communication partners*
IRB Protocol Number: 10724

Dear Dr. Hengst:

This letter authorizes the use of human subjects in your continuing project entitled *An Innovative Clinical Intervention for adult-acquired cognitive-communication disorders: A feasibility study of a protocol using collaborative referencing tasks and clinicians as communication partners*. The University of Illinois at Urbana-Champaign Institutional Review Board (IRB) approved the protocol as described in your IRB application, by expedited continuing review. The expiration date for this protocol, IRB number 10724, is 06/02/2017. The risk designation applied to your project is *no more than minimal risk*.

Note: Previous IRB approval for this protocol expired on 05/27/2016. All research activities should have stopped between 05/27/2016 and 06/03/2016. Data collected during this period may not be used.

Copies of the attached date-stamped consent form(s) must be used in obtaining informed consent. If there is a need to revise or alter the consent form(s), please submit the revised form(s) for IRB review, approval, and date-stamping prior to use.

Under applicable regulations, no changes to procedures involving human subjects may be made without prior IRB review and approval. The regulations also require that you promptly notify the IRB of any problems involving human subjects, including unanticipated side effects, adverse reactions, and any injuries or complications that arise during the project.

If you have any questions about the IRB process, or if you need assistance at any time, please feel free to contact me at the OPRS office, or visit our Web site at http://oprs.research.illinois.edu.

Sincerely,

Rebecca Van Tine

Rebecca Van Tine, MS
Human Subjects Research Specialist, Office for the Protection of Research Subjects

Attachment(s): 4 consent forms

c: Suma Devanga

UNIVERSITY OF ILLINOIS
AT URBANA - CHAMPAIGN

College of Applied Health Sciences
Department of Speech and Hearing Science
901 South Sixth Street
Champaign, IL 61820-6206

Primary Participant Informed Consent Form

Project Title: *An innovative clinical intervention for adult-acquired cognitive-communication disorders: A feasibility study of a protocol using collaborative referencing tasks and clinicians as communication partners*

Principal Investigator: Julie A. Hengst, Ph.D., Associate Professor in the Department of Speech & Hearing Science, University of Illinois at Urbana-Champaign (phone: 244-6149; hengst@illinois.edu)

Purpose of this Research Project

This research study examines a new collaborative treatment protocol designed to improve the communication abilities of individuals with cognitive-communication disorders. The protocol uses a barrier task in which the clinician and client sit at a table facing each other over a low barrier, and then work together to successfully identify and place target photo cards on their playing boards. In our earlier research using this collaborative barrier task, participants demonstrated improvements in their abilities to identify and recall names for different objects, events, locations and people pictured on the cards. Improvements were seen both during the task and in conversations outside of the task. The treatment protocol provides the client-partner pair repeated opportunities to label target photo cards, with six trials completed in each of 15 treatment sessions.

The goal of this study is to see if this 15-session treatment protocol can be used successfully with clients who have different cognitive communication disorders and to see if multiple communication partners can easily learn to be treatment partners. Findings from this study will help us decide if additional studies should be done before we are ready to conduct a larger, controlled treatment trial that would compare this collaborative treatment with more traditional clinician-directed treatments.

Length of Participation

To participate in the project you will be asked to attend a total of 25 sessions across 8-9 weeks. We will work with you so that we can schedule 2-3 sessions a week at your convenience.

What you will be asked to do

- Attend four 60-90-minute evaluation sessions—during these sessions you will: a) be given standard cognitive and communication tests; and b) be interviewed about your communication difficulties in order to identify treatment targets.
- Attend six 45-minute baseline game-like barrier task sessions with the clinician-researcher – three before and three after treatment.
- Attend fifteen 45-minute treatment sessions—the treatment describing photographs and completing six trials of a game-like barrier task with the researcher each session.

you will be asked to watch a video sample of the primary participant's conversation and will be trained to rate the communication abilities of the primary participant and his/her communication partner.

- Observe six 45-minute baseline game-like barrier task sessions with the clinician-researcher—three before and three after treatment and rate the communication performance.
- Observe fifteen 45-minute treatment sessions and rate the communication performance—the treatment describing photographs and completing six trials of a game-like barrier task with the primary participant and the researcher.
- All the sessions will be held at the primary participant's home (the researcher will visit their home for every session).
- Agree to allow all sessions to be video and audio recorded for data analysis, and if you agree, to also allow video clips to be used in research reports.

Your Participation is Voluntary

Participation in this project is voluntary, and you may withdraw from this project at any time. Your decision to participate or not will not alter your rights to receive any services that you are entitled to. Specifically, if you are employed by, receive services from, or are otherwise affiliated with the University of Illinois your decision to participate, decline, or withdraw from participation in this study will have no effect on your status at, or future relations with the University of Illinois.

Benefits

As a secondary participant in this study, you are likely to gain better communication strategies to use with the person with aphasia, and you will have access to students and professionals who have expertise in supporting communication in speech language therapy services. More broadly, the results of the project will be used to improve treatment approaches available to speech-language pathologists to use with clients who have acquired communication disorders.

Risks to you

There are no physical risks associated with this project. It is possible that interview questions may touch on uncomfortable challenges that can arise in everyday communication, educational and therapeutic processes. You are welcome to decline to respond to that question. There is also a possibility that someone, especially people who already know you, may be able to identify you from the video tapes, although we do follow set procedures to minimize your risk of being identified.

Confidentiality

The project is designed to minimize your risk of being identified. Specifically:

- For research sessions held at the Speech Language Pathology Clinical Building (Oak Street) the closed-circuit video system will be used to record sessions; these recordings will be automatically discarded from the system within two weeks, and only DVD recordings will be kept for this research study.
- All data from your session (e.g., researcher notes and digital recordings) will be labeled with a participant identification number and/or a pseudonym

Faculty, students and staff who may see your information will maintain confidentiality to the extent of laws and university policies. Personal identifiers will not be published or presented.

How the results of the data from this project will be used:

The results of this research will be presented in professional publications and at professional conferences and/or other educational and professional settings (e.g., lectures to university students). These reports may be in both written and oral form and will include examples from the data collected. These examples may include written transcripts and/or audio samples of the speech of participants as well as still and/or video images of the participant during these sessions.

****

Written Consent to Participate as Described above:

I have read the above information about this project and have received a copy of this consent form for my records. A member of the research team has discussed the details of this project with me and answered my questions about the procedures, benefits and risks involved. I assert that:

- I am 18 years of age or older;
- I voluntarily agree to participate in this study;
- I agree to have all sessions video recorded for analysis;
- I also agree to have audio and video clips used in the following way (circle one):
  - audio & video clips may be used in research reports (as described above)
  - audio and video clips may be used only in analysis, NOT in research reports

Print Participant's Name	Participant Signature	Date
Print Name of Guardian (if applicable)	Guardian Signature	Date
Print Researcher's Name	Signature of Researcher	Date

For Further Information:

Please contact the researcher listed above at 333-2230 or Dr. Julie Hengst, Principal Investigator, at 244-6149 if you have any questions, or concerns about this research. If you have any questions about your rights as a participant in this study, please contact the University of Illinois Institutional Review Board at 217-333-2670 or via email at irb@uiuc.edu .

University of Illinois at Urbana-Champaign
Institutional Review Board
Approved: 6/3/16
Expires: 6/2/17
IRB #: 10724

UNIVERSITY OF ILLINOIS
AT URBANA – CHAMPAIGN

College of Applied Health Sciences
Department of Speech and Hearing Science
901 South Sixth Street
Champaign, IL 61820-6206

Secondary Participant- Informed Consent Form

Project Title: *An innovative clinical intervention for adult-acquired cognitive-communication disorders: A feasibility study of a protocol using collaborative referencing tasks and clinicians as communication partners*

Principal Investigator: Julie A. Hengst, Ph.D., Associate Professor in the Department of Speech & Hearing Science, University of Illinois at Urbana-Champaign (phone: 244-6149; hengst@illinois.edu)

Purpose of this Research Project

This research study examines a new collaborative treatment protocol designed to improve the communication abilities of individuals with cognitive-communication disorders. The protocol uses a barrier task in which the clinician and client sit at a table facing each other over a low barrier, and then work together to successfully identify and place target photo cards on their playing boards. In our earlier research using this collaborative barrier task, participants demonstrated improvements in their abilities to identify and recall names for different objects, events, locations and people pictured on the cards. Improvements were seen both during the task and in conversations outside of the task. The treatment protocol provides the client-partner pair repeated opportunities to label target photo cards, with six trials in each of the 15 treatment sessions.

The goal of this study is to see if this 15-session treatment protocol can be used successfully with clients who have different cognitive communication disorders and see if multiple communication partners can easily learn to be treatment partners. Findings from this study will help us decide if additional studies should be done before we are ready to conduct a larger, controlled treatment trial that would compare this collaborative treatment with more traditional clinician-directed treatments.

Why are we contacting you?

We are contacting you because the primary participant requested you to be a part of the treatment study.

What are we asking you to do?

For you and your spouse/person with aphasia to participate in 6-10 weeks of data collection, including:

- Interviews- with the two of you to discuss the primary participant's communication difficulties, real-life problems, and patterns of communication observed from watching video samples of the primary participant.
- Observations- of you during interacting with the primary participant during his/her treatment session or interview session; a portion of these observations will be video recorded.

Length of Participation

To participate in the project you will be asked to attend a total of 25 sessions across 8-9 weeks. We will work with you so that we can schedule 2-3 sessions a week at your convenience.

What will you be asked to do?

- Attend four 60-90-minute evaluation sessions—two before and two after treatment--during these sessions you will be interviewed about the primary participant's communication difficulties, and

- All the sessions will be held at your own home (the researcher will visit your home for every session).
- Agree to allow all sessions to be video and audio recorded for data analysis, and if you agree, to also allow video clips to be used in research reports.
- Provide release of medical information to allow researchers to review evaluation and treatment records related to your brain injury and cognitive-communication disorder.

Your Participation is Voluntary

Participation in this project is voluntary, and you may withdraw from this project at any time. Your decision to participate or not will not alter your rights to receive any services that you are entitled to. Specifically, if you are employed by, receive services from, or are otherwise affiliated with the University of Illinois your decision to participate, decline, or withdraw from participation in this study will have no effect on your status at, or future relations with the University of Illinois.

Benefits

The collaborative barrier task treatment protocol is designed to help individuals with communication disorders like the ones you report having. In past studies participants have shown improvements both in completing the task and in talking about the everyday events, activities, people, and places that were included on the photo cards. You may also experience similar success or improvements. In addition, if you want (and with your written permission) we will give the findings of this project specifically related to you to your current speech-language pathologist.

More broadly, the results of the project will be used to improve treatment approaches available to speech-language pathologists to use with clients who have acquired communication disorders.

Risks to you

There are no physical risks associated with this project. There is a possibility that someone, especially people who already know you, may be able to identify you from the video tapes.

Confidentiality

The project is designed to minimize your risk of being identified. Specifically:

- For research sessions held at the Speech Language Pathology Clinical Building (Oak Street) the closed-circuit video system will be used to record sessions; these recordings will be automatically discarded from the system within two weeks, and only DVD recordings will be kept for this research study.
- All data from your session (e.g., researcher notes and digital recordings) will be labeled with a participant identification number and/or a pseudonym
- Data excerpts used in professional workshops will be edited to assure that, other than your image, any identifying information (e.g., your name) is excluded.

Faculty, students and staff who may see your information will maintain confidentiality to the extent of laws and university policies. Personal identifiers will not be published or presented.

- Data excerpts used in professional workshops will be edited to assure that, other than your image, any identifying information (e.g., your name) is excluded.

How the results of the data from this project will be used:

The results of this research will be presented in professional publications and at professional conferences and/or other educational and professional settings (e.g., lectures to university students). These reports may be in both written and oral form and will include examples from the data collected. These examples may include written transcripts and/or audio samples of the speech of participants as well as still and/or video images of the participant during these sessions.

****

Written Consent to Participate as Described above:

I have read the above information about this project and have received a copy of this consent form for my records. A member of the research team has discussed the details of this project with me and answered my questions about the procedures, benefits and risks involved. I assert that:

- I am 18 years of age or older;
- I voluntarily agree to participate in this study;
- I agree to have all sessions video recorded for analysis;
- I also agree to have audio and video clips used in the following way (circle one):
  - audio & video clips may be used in research reports (as described above)
  - audio and video clips may be used only in analysis, NOT in research reports

Print Participant's Name	Participant Signature	Date
Print Name of Guardian (if applicable)	Guardian Signature	Date
Print Researcher's Name	Signature of Researcher	Date

For Further Information:

Please contact the researcher listed above at 333-2230 or Dr. Julie Hengst, Principal Investigator, at 244-6149 if you have any questions, or concerns about this research. If you have any questions about your rights as a participant in this study, please contact the University of Illinois Institutional Review Board at 217-333-2670 or via email at irb@uiuc.edu .

University of Illinois at Urbana-Champaign
Institutional Review Board

Approved: 6/3/16
Expires: 6/2/17
IRB #: 10724

Appendix C

Mediated Discourse Elicitation Protocol for Conversation Probe

Source: (Hengst & Duff, 2007)

Activity Frame	Goals addressed in activity	Clinician's collaborative role in accomplishing activity
Target discourse sampling	Three target discourse types: 1. Conversational 2. Personal narratives 3. Procedural	Clinician in communication partner role, marked by- 1. Clinician responds to content of client talk and provides appropriate reception (e.g., conversation partner; narrative audience). 2. Topics discussed are personal and social in nature. 3. Clinician provides interactional support and follows client's lead.
Transitioning	1. Make shifts in activities visible 2. Create opportunities for non-prompted talk 3. Create and maintain conversational framework for session through use of small talk	Clinician in communication partner role, marked by: 1. Formally marks end of the 10-minute conversation task 2. Makes conversational small talk 3. Responds to conversational offers by client

Appendix D

Communication Confidence Rating Scale for Aphasia (CCRSA)

(Babbitt & Cherney, 2010)

|_____|_____|_____|_____|_____|_____|_____|_____|_____|_____|_____|

0 10 20 30 40 50 60 70 80 90 100

Not confident **Moderately confident** **Very confident**

1. How confident are you about your ability to talk with people? _____
2. How confident are you about your ability to stay in touch with family and friends? _____
3. How confident are you that people include you in conversations? _____
4. How confident are you about your ability to follow news and sports on TV? _____
5. How confident are you about your ability to follow movies on TV or in a theatre? _____
6. How confident are you about your ability to speak on the telephone? _____
7. How confident are you that people understand you when you talk? _____
8. How confident are you that you can make your own decisions? _____
9. How confident are you about your ability to speak for yourself? _____
10. How confident are you that you can participate in discussions about your finances? _____

Appendix E

Conversation Profile

Based on Whitworth, Perkins and Lesser (1997) - Conversational Analysis Profile for People with Aphasia (CAPPA).

1.	STYLES OF CONVERSATION	Pre-Stroke	Pre-Treatment	1st Tx week	2nd Tx week	3rd Tx week	4th Tx week	5th Tx week	Follow-up
A.	Talkative								
	A good listener								
	Passive								
	Hesitant								
	Argumentative								
	Serious								
	Quiet								
	A bad listener								
	Dominant								
	Articulate								
	Easy-going								
	Humorous								
B.	Speak softly								
	Mumble								
	Speak quickly								
	Enjoy chit-chat								
	Seldom start conversation								
	Enjoy talking to people								
	Often interrupting								
	Swear a lot								
	Speak loudly								
	Speak clearly								
	Speak slowly								
	Avoid chit chat								
	Start conversation easily								
	Show reluctance to talk								
	Seldom interrupt								
	Hardly ever use swear words								

2.	PEOPLE	Pre-Stroke	Pre-Treatment	1st Tx week	2nd Tx week	3rd Tx week	4th Tx week	5th Tx week	Follow-up
	Wife/Husband								
	Sons and/ Daughters								
	Grand-children								
	Other family members								
	Friends								
	Neighbors								
	Strangers								
	Colleagues								
	Others specify								

3.	SITUATIONS	Pre-Stroke	Pre-Treatment	1st Tx week	2nd Tx week	3rd Tx week	4th Tx week	5th Tx week	Follow-up
	Answering the telephone								
	Ringing people								
	At home with family								
	At home with visitors								
	Answering the door								
	In shops								
	Attending meetings								
	At social clubs								
	In buses								
	At church								
	At mealtime								
	Visiting friends								
	Visiting families								
	Playing board/card games								
	Others								

4.	TOPICS	Pre-Stroke	Pre-Treatment	1st Tx week	2nd Tx week	3rd Tx week	4th Tx week	5th Tx week	Follow-up
	News								
	Television								
	Own ideas								
	Plan for future								
	Work								
	Politics								
	Religion								
	Family								
	Friends								
	Other people								
	Past events/times								
	Sports								
	Immediate plan								
	Daily routine								
	Finance								
	Other								

Appendix F

Contact Diary

Source: (Hengst, 2001)

Contact Diary Instructions: In this diary, I want you to tell me about the successes and problems you have when you are talking to each other as well as to other people. Tell me how you resolve communication problems, if you do, and about any new ways of communicating you develop. For each entry please answer these questions:

What was the date and time of day? (e.g., **3/7/97, 10** am)

Where were you, what were you doing, and who was there? (e.g. Jack and I were in the kitchen and he was telling me what he wanted for lunch, I was doing the dishes)

Was the communication successful or problematic? How did you react to it? Was it frustrating or funny?

How did other people react to it? If it was problematic, what did people do to resolve it? Who and what was helpful?

Was any new or creative communication strategy used? This may be using a new word, successfully interacting with a new person, or something much more elaborate.

Please write in the diary at least once a day. If you don't notice any unusual communication problems or successes you may simply say that. However, it will be easier to write about communication events if you write them down soon after they happen.

We will talk about what you write in the contact diary and how you are communicating at home during every assessment session (after every three treatment sessions).

Contact Diary

Please fill out this form for the dates listed. I would like to know all the people that you talk with on each of these dates. Also, include the time of day, where you were, who you were with, and briefly what you talked about.

Day and Date: _____

Time	Where you Were	Who you talked with	What you talked about	Success/Failure?	Comments

Appendix G

Barrier Treatment Protocol

The game will be played six times each session. The matcher/director roles will alternate across the six trials, every session, with client directing first. Measures include correct number of card placements and appropriate labels for each card time to complete each trial.

Barrier Game Set-Up

Set-up and Materials: Subjects will be sitting at a table, facing each other. Researcher will be on the side. Cameras will be in a fixed location on each side of the table so as to make both the participants' faces and the matcher's board visible. Playing boards, cards, and barrier will not be in place. At the beginning of each session, the following instructions will be given.

1. Game Instructions:

"I want you to play this matching game; we're going to call it the barrier task. Each session you will play the game six times. And, I will record you playing the game together. It should be fun, kind of like Solitaire or a puzzle. Do you like games?" (pause for answer) "Today, I will teach you how to play, but it is very easy and there are very few rules."

2. Playing Boards:

"You each have a playing board in front of you." (Place board in front of each player) The two boards are identical. They each have 12 spots on them, 6 in the first row and 6 in the second row. Each spot is numbered 1 through 12 – 1, 2, 3 (count out all 12 while pointing to each spot on the board in front of the individual with amnesia).

3. Playing Cards:

"You each have a set of 12 pictures. Both sets are identical." (fan out the two sets of cards but don't allow for discussion of pictures) "See how there is just enough room for all 12 cards" (Pick up cards again to decrease likelihood of discussion of the pictures). Ask patient first then partner, ("Do these look familiar? Have you ever seen these before?") These questions will be asked at the beginning of each session."

4. Director and Matcher:

"To play this game, one person is the director and one person is the matcher. You will take turns being the director and the matcher. The director starts with his/her picture cards already on the playing board. Then the director tells the matcher which picture card to put in each numbered spot, starting with spot one (point to each spot as mentioned) then spot 2, spot 3, through spot 12. At the end, we check to see if the matcher's board looks like the director's board."

5. Barrier

"However, to make sure that the matcher doesn't just look at the order of cards on the director's board, I will put this barrier between you." (place barrier) "Now, can you see each other okay?"

6. Labeling the Cards

"In addition to getting the cards in the correct place on the matcher's board, you must work together to come up with a name or label for each card. There may be more than one correct name or label for these pictures. It doesn't matter which one you use, but you need to use an accurate one. So if there were a picture of me, you couldn't say 'my teacher', because I am not your teacher."

7. Full Communication

"You can't move or look around the barrier. Other than that, anything goes! Be creative! You can use the cards in any way that you want to. You can use gestures, facial expressions, and you can both talk as much as you want to .The only thing you can't do is move the barrier and look at the order of the cards on the director's playing board."

At the beginning of each trial the following tasks will also be done:

1. Assigning Roles

"Each time we play, you will take turns being the director. Since we are playing 6 times, *PWA* you will be the director 3 times and *Partner,* you will be the director 3 times. *PWA,* you will be the director for this first trial." (For this second trial—"*PWA* you directed last time, so this time *Partner* will direct and you will be matcher).

2. Setting up Cards

"So, *partner*, we will set up your cards so that you can easily see all of them." Stand cards up against barrier in one long row, above the playing board. "Can you reach all of these?" "*PWA,* we are going to set your cards on the playing board in this order" (show *PWA* the master sheet and start placing cards on playing board. Encourage *PWA* to help if he shows any inclination to do so, saying things like thank you, yep that's right, let's check, etc.)

3. Reviewing the Rules: "Remember there are only four rules."
"1st, the matcher must put the cards on the grid where the director tells you to. The director can start with spot number one, then spot two, then three, and so on until all 12 are done."

"2nd, for each card you need to work together to come up with an accurate label for the card"

"3rd, you can talk together as much as you want and use any gestures you want, both to help you place the cards and to help you name the cards."

"4th, you cannot look at the order of the cards on each other's boards, so you cannot remove the barrier."

Finally, I will leave the room while you are playing the game. I'll be in the observation room on the other side of the glass. So, tell me when you are done with each trial and I'll come back in the room and check your cards.

Scoring: "You get points in this game in two ways."

"First, you get a point for every card that the matcher places in the right spot. So, I'll check your boards at the end of each game to see how many cards you got right."

"Second, you get points for saying a correct or accurate name or label for the picture. So, while I'm in the observation room I'll keep track of the labels you are using for the cards. Also, we are recording the game so that I can check the tape in case I miss what you say."

Count without moving the barrier. Go through the cards one at a time and tell the partners which cards were right/wrong. E.g., "okay, number one is right, two is right, three is the wrong card, four is right…". Be conversational and be a resource, IF they ask—e.g., "did you write down what we called this card? Yes, I have that you called it Hessel and Grant."

Appendix H

Fidelity of Baseline, Treatment Probe, and Maintenance Sessions

Instructions: You will be asked to observe all five baseline, treatment probe, and maintenance sessions. Please rate the treatment using the following fidelity scale by circling the appropriate number.

	0-Did not match the treatment protocol	1- Matched the treatment protocol
1. 12 pictures in the naming task		
2. Partner offering the label only when asked for by the PWA		
3. Opportunity for multimodal response		
4. Moving the participants to a comfortable conversational setting		
5. Allowing the participants to choose the topic of conversation		

Appendix I

Treatment Fidelity Scale

Instructions: You will be asked to observe five random treatment sessions. Please rate the treatment using the following fidelity scale by circling the appropriate number. Please refer to the Barrier Treatment Protocol (Appendix G) before continuing with the rating.

	0-Did not match the treatment protocol	0.5-Somewhat matched the treatment protocol	1- Matched the treatment protocol
1. Barrier game set-up			
2. Game instructions			
3. Photo-cards			
4. Director-matcher roles			
5. Setting up of cards			
6. Role of the moderator			
7. Adherence to the 4 rules			
8. Role of the partner as a "communication partner"			
9. 90% accurate card labels			
10. Development and use of card labels that simplify across trials			

Appendix J

Social Validity Interview format

The following questions will be asked in the social validity interview to the target PWA, their family and the clinician partner (Horner et al., 2005; Wolf, 1978)

1. What did you think of the treatment?

2. What according to you was the impact of the treatment?

3. Were the goals of the treatment important to you?

4. Were the effects of the treatment significant to you?

5. Do you think the treatment procedure is appropriate (in terms of ethics, cost, and practicality)?

6. Would you continue this procedure after the end of this study?

Appendix K

Glossary

1. PWA: Person with Aphasia
2. ICF: International Classification of Functioning, Disability, and Health
3. WHO: World Health Organization
4. WAB: Western Aphasia Battery
5. BDAE: Boston Diagnostic Aphasia Examination
6. CSD: Communication Sciences and Disorders
7. BTP: Barrier Treatment Protocol
8. SCD: Single-case Experimental Design
9. CCN: Collaborative Confrontation Naming
10. PICA: Porch Index of Communicative Ability
11. CP: Conversation Probe
12. CPS: Card Placement Sequence
13. ATL: Agreed-upon Target Label
14. RATL: Repetition of Agreed-upon Target Label
15. NATL: Non Agreed-upon Target Label
16. RNATL: Repetition of Non Agreed-upon Target Label
17. IRE: Initiating Referencing Expression
18. BE/MBE: Basic Exchange/Modified Basic Exchange
19. IDR: Interactional Discourse Resource
20. PRO: Patient-Reported Outcome
21. CAPPA: Conversational Analysis Profile for People with Aphasia
22. CCRSA: Communication Confidence Rating Scale for Aphasia